블록체인 기술에 의하여 강화된 학습자 중심의
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A Learner-Centered Approach for University Liberal Art
Education Empowered Blockchain Technology*

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■ Abstract ■

Recently, there have been a number of researchers in the field of education who are actively exploring the educational applications of Blockchain technology, even though it is still in its infancy. Some researchers have been investigating its application in educational administration to issue academic credentials' or maintain student records with distributed ledger, which is the basis of Blockchain technology. Whereas, others have been examining its application in redesigning learning systems that are being used in various contexts, including online learning and lifelong education. In that vein, this paper aims to discuss a liberal arts education system which will be supported by Blockchain-based 'smart contracts'. At present, active efforts are being made to innovate liberal arts education in Korea, centered around government-funded university innovation projects and there have been reports of great achievements. However, if the Blockchain technology is applied to innovating the liberal arts education, we will innovate not only the liberal arts education but also university education as a whole. In this paper, there are suggestions on how to build a learner-centered educational environment where a liberal arts education system is supported by Blockchain-based smart contracts. First of all, the current innovation in liberal arts education and its limitations are discussed, followed by ways in which Blockchain-based smart contracts can reframe the liberal arts education system. Last but not least, the paper addresses implications of the Blockchain technology applications in liberal arts education, along with their future prospects.

Keyword : Liberal Arts Education, Blockchain Technology, Smart Contracts,
          Learner-Centered Educational Environment, University Education Innovation

1. Introduction

With the advent of the 4th industrial revolution and in response to a rapidly changing and technologically advanced society, Korea has seen a rise in the number of academic studies conducted on the topic of reorganization of university liberal arts education, which is also known as '*general education*', by and large. Most of those studies have 1) discussed a new direction for the future liberal arts education should take, 2) suggested new instructional methods, and 3) proposed developing new educational courses in liberal arts. In parallel, there have been projects to reorganize liberal arts education in line with research outcome, as part of government-funded university innovation projects, including ACE,[1] and PRIME.[2]

Though these projects have yielded great results, yet there are still more room for improvement, given our rapidly changing society. It is imperative to introduce new technologies to education in order to control quality and to provide courses tailored to students and social demands with more efficiency. To this end, this paper suggests the application of Blockchain technology, a new technology that will lead the 4th industrial revolution, to the development and management of liberal arts education program.

2. Research Methodology

The present study is a conceptual study, based on literature reviews. While an empirical research paper consists of theoretical frameworks, quantitative or qualitative data, and a series of analyses, a conceptual paper selects theories or concepts, analyzes them, and describes different perspectives (Jaakkola, 2020, p. 20). That is, while (in)dependent variables are studied in empirical research, key concepts are analyzed in a conceptual paper prior to generating any novel insights. According to Jaakkola (2020), there are four approaches to conceptual paper: i)theory synthesis, ii)theory adaptation, iii)typology, and iv)model (Jaakkola, 2020, p. 22). Out of them, '*model*' was chosen for the purpose of this study. '*Model*' is often used to build a theoretical framework that predicts relationships between constructs.
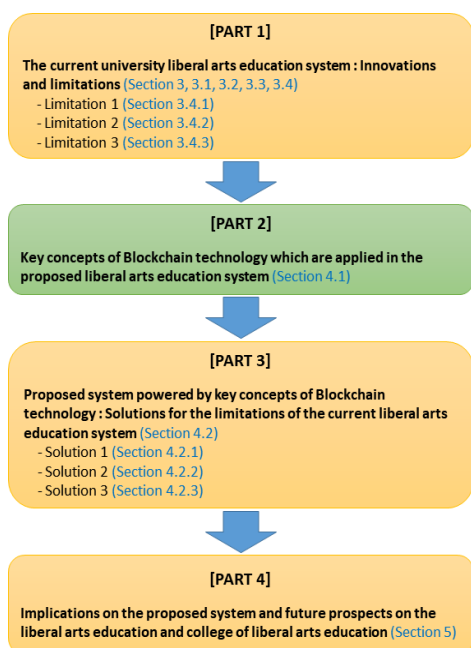
In this study, a new concept of university liberal arts education is proposed on the back of Blockchain technology, one of the promising technologies in this era, along with suggestions of how to make this newly proposed system work effectively. It is expected that constructs and relationships in the proposed system are likely to solve the limitations of the current liberal arts education. To this end, the following research procedure is employed.

As can be seen in [Figure 1], the present study is broken down into four parts and three sections. In section 3, the current state of university liberal arts education is examined. In particular, there is a review of the current innovation in reforming the liberal arts education system as part of a government-led project and its limitations. Section 4 addresses suggestions for a liberal arts education system that will be empowered by Blockchain technology. Some of the key concepts of Blockchain technology, which will be applied to the proposed system, are discussed in section

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1) ACE is the abbreviation of Advancement for College Education (Kim, 2016).
2) PRIME is the abbreviation of Program for Industrial needs-Matched Education (Hong, 2016).

4.1. And section 4.2 introduces a set of new innovation in liberal arts education centered around the key concepts of Blockchain technology which are previously discussed in the preceding section. In particular, solutions are presented to overcome limitations of the current liberal arts education system that are discussed in 3.4. Finally, there are implications and future prospects of the Blockchain technology applications in liberal arts education in section 5.

[PART 1]

The current university liberal arts education system : Innovations and limitations (Section 3, 3.1, 3.2, 3.3, 3.4)
- Limitation 1 (Section 3.4.1)
- Limitation 2 (Section 3.4.2)
- Limitation 3 (Section 3.4.3)

[PART 2]

Key concepts of Blockchain technology which are applied in the proposed liberal arts education system (Section 4.1)

[PART 3]

Proposed system powered by key concepts of Blockchain technology : Solutions for the limitations of the current liberal arts education system (Section 4.2)
- Solution 1 (Section 4.2.1)
- Solution 2 (Section 4.2.2)
- Solution 3 (Section 4.2.3)

[PART 4]

Implications on the proposed system and future prospects on the liberal arts education and college of liberal arts education (Section 5)

[Figure 1] Research Procedure

3. The Current State of University Liberal Arts Education in Korea

3.1 Liberal Arts Education vs. General Education

In 'liberal arts', 'liberal' means 'free' and 'arts' means 'individual skills'. This is taken from a report titled '*Report of the task force on general education*' which was released by Harvard university in 2007 (Peak, 2017). According to the report, 'liberal education' means an education that fosters a free spirit of criticism whereas 'arts education' is relevant to a kind of skills education. Here, skills include the concept of technique. And 'technique' refers to the same skill equally acquired by anyone, whereas 'art' refers to a 'technique' that is acquired uniquely and different from person to person (Harvard University, 2007). Meanwhile, the term, 'general education' is being used interchangeably with 'liberal arts education' in Korea. Historically, the term has been used to distinguish from major education. However in these days, its concept has been changed and used to mean 'basic education' alongside 'liberal arts education' (Park, 2020). This is one of the reasons why these two terms are being used interchangeably. As a result, there is a widespread tendency to confuse 'liberal arts' with 'humanities' in Korea. As such, it is easy to find some universities where a 'College of Humanities' is labeled as a 'College of Liberal Arts', which is, strictly speaking, incorrect (Kim, 2018).

In this paper, the term, 'liberal arts' is used even as it is being used at many universities to mean 'general education' at the moment. Because the concept of liberal arts education in this study is closer to the aforementioned original concept of 'liberal' and 'arts', rather than the concept of basic education which is provided in preparation for major concentrations.

3.2 Standard General Education Model of KONIGE and Other Related Discussions

The Korea National Institute for General

Education (hereafter referred to as KONIGE) uses the term, 'general education' instead of the term 'liberal arts education' adopted in this paper. According to KONIGE, there is a standard model of general education, which consists of three components. They are i) literacy education, ii) knowledge education in the fields of humanities, social sciences and natural sciences, and iii) physical, emotional, and social experience education, including personality education (KONIGE, 2021). In fact, since the KONIGE model encompasses all disciplines that can be taught at universities, it is quite difficult to define the characteristics of general education. Therefore, the identify or direction of liberal arts education has been defined and presented in a variety of ways by different researchers (Peak, 2017). While there has always been constant ongoing research into the identify or direction of liberal arts education in line with the transformation and development of the university academic structure (Kang and Kim, 2010), nowadays some researchers have started to emphasize the importance of curriculum on knowledge and technologies which correspond to a rapidly changing society brought on by the 4th industrial revolution (Peak, 2017).

3.3 Transforming Liberal Arts Education with Government-Funded Innovation Projects

The advent of the 4th industrial revolution has been transforming many things in our society. Higher education institutions including universities are no exception. In fact, universities were already been in crisis even before the advent of the 4th industrial revolution. The following crises are some of the crises which plague universities for a long time (Selingo, 2013; Yun, 2021). First

is a financial crisis due to a drop in the student population. Second is the emergence of educational services that threaten to replace university education. Third is the inconsistency between students' career choices and available major programs due to the rigid university academic structure. Fourth is a failure to offer education in line with social demand. Yet, the rapid development of technology brought on by the 4th industrial revolution is exacerbating these prolonged crises which the universities have long been exposed to. Currently, most universities are putting their best foot forward to bringing about innovation, with a view to overcome the crises, and stay relevant and on top of future change.

In Korea, university transformation is being carried out under a government-funded university innovation policy. With government-funded innovation projects such as ACE (Kim, 2016) and PRIME (Hong, 2016), universities are i) reinforcing the student service systems to prevent students from dropping out, ii) trying out technology-enabled learning in a variety of learning environments, and iii) improving instructional methods to raise humans with convergence ability demanded by society. Most of all, universities are making great efforts to improve their existing curricula or to develop a new curriculum in order to meet social demands and learners' needs.

In line with various transitions in the university academic structure, liberal arts education has transformed, and now is once again attempting for a change while redefining its identity and direction (Lee, 2018). Such move is more pronounced in colleges of liberal arts than any other departments on campus. Liberal arts colleges are active in taking the lead to i) develop and operate

new courses on knowledge and skills required by a new era and society, and ii) apply new instructional methods suitable for new generations. Some universities, in particular, are pushing to use a college of liberal arts (i.e., a college of general education in their term) as a test bed for university innovation. This is probably in part because a college of liberal arts is more flexible relative to other colleges or departments on campus.

Most universities focus on the development of new academic courses that align with the trend of technological changes and meet the demand of educational consumers while conducting government-funded liberal arts education innovation projects.

As one example, these universities have introduced 'academic course development competition' among their full-time faculties, and selected courses that are highly preferred by experts in and out of the universities or through a student survey (Song, 2017). Currently, most of the universities in Korea have been developing or revamping their liberal arts curricula in ways similar to the above method.

3.4 Limitations of the Current Liberal Arts Education Innovation Projects

As has been mentioned in 3.3, the government-funded projects specifically for university liberal arts education innovation have greatly enabled universities to provide education that meets social demands and learners' needs. However, they face the following limitations in terms of ever rapidly changing social demand and learners' needs to respond to it.

3.4.1 Limitation 1: Long and Complex Process of Curriculum Development

The first limitation faced by the current liberal arts education innovation projects is related to processes in academic course development. New academic courses are usually packed with contents that are not available in the existing curricula but highly relevant to and demanded by society. Also, new instructional methods are used in order to improve learners' competencies. Examples of such courses can include 'Fourth Industrial Revolution and Startup', 'Data Visualization and Social Problem Solving', 'Health System Design using Big-data & AI' and 'Sustainable City and Social Living Lab' (Lee, 2021; Sookmyung University Internal Resource, 2021).

Of course, the above-mentioned courses have been developed with great care in accordance with social demand and learners' needs, and therefore, they show a high level of learner satisfaction. Yet, they take too much time and go through a lengthy process for development and operation. In other words, for a new course to be developed and operated, there are numerous approvals to be obtained from university committees and countless reports to be submitted. In many cases, such processes are complex and time-consuming. As a result, universities unnecessarily spend too much time and effort in developing a single course while students pay out of pocket to take similar courses at private educational institutions. Hence, it is a loss of money as well as time and effort for students, while universities may lose the original justification to meet social demand with new course development. In order to save the money, time, or effort of students, and also to lead social change, not just simply responding to social change, universities need to develop an

efficient course development system that streamlines the existing curriculum development processes.

3.4.2 Limitation 2: Restriction on New Curriculum Development

The second limitation is restriction on new course development and teaching activities, which are only available to full-time faculty members. Certainly, the existing full-time faculty members have done their best to provide the current level of education. However, they can do only so much with what they have to innovate and improve the existing curricula, as it may be difficult and challenging for them alone to address a rapidly changing social demand and match it with a new educational course that train students to acquire a new skill set needed by society. Then, new academic courses and teaching activities are bound to be limited. In order to overcome these limitations, it is necessary to extend new course development to experts of relevant subject matters. Moreover, it is important for universities to use and recognize experts as independent contractors, not as assistants to university faculties with titles such as an advisory committee member or a formal/informal mentor. Though full-time faculty members are also experts in their fields and can collaborate among them, there may still be limitations, given the current social conditions. To truly achieve innovation in university education, it is essential to establish a robust and extensive network with outside experts.

3.4.3 Limitation 3: Inconvenience of not being able to immediately prove course completion

The third limitation is related to proof of learning. With the current university system, students are not issued an immediate proof of learning, which makes it difficult to manage their own careers while in university. As may be well known by now, people no longer go to university for a lifelong job. Now more than ever, it is increasingly becoming difficult to have a lifelong job with the knowledge and skills gained from university education. In fact, a concept of lifelong job seems to be disappearing. And it is increasingly becoming an era where students must engage in a variety of learning both within and outside the walls of a university, in order to gain the knowledge, skills, and competencies required by society. In fact, it is becoming an era in which students do not need to wait until graduation to get a job. Besides, graduates have to go back to university when they need new knowledge, skills, and competencies for a job or career. In such a rapidly changing society, if universities can provide students with immediate proof of learning, it will greatly help them plan careers well in advance. Under the current liberal arts education system, no matter how hard students complete the courses with highly social demands, it is very difficult to use the learning outcomes immediately to start planning their career while in university. The proof, i.e., records of course completion, which is provided after university graduation might be too late for them to use practically. Students should be able to make use of the proof of learning in liberal arts education, not only after graduation but during their stay in university. While in university, the students should be able to access data that are relevant to their learning experiences and to use it as the basis for other activities, which may help start or build their careers.

4. Reframing Liberal Arts Education Innovation with Blockchain Technology

This section addresses ways in which limitations of the existing liberal arts education innovation can be overcome with Blockchain technology. To be specific, Blockchain and associated technologies are outlined, followed by the description of a learner-centered liberal arts education landscape based on these technologies.

4.1 Blockchain and Related Technologies

In 4.1, the basic features of Blockchain and associated technologies are reviewed. Specifically, their major characteristics due to the fundamental nature of Blockchain, including 'security', 'immutability', 'reliability' and 'transparency' are introduced, followed by 'smart contracts'.

4.1.1 Distributed Ledgers and Blockchains

A Blockchain is the specific type of a distributed ledger, a record of decentralized entries with no central registry (Marjit and Kumar, 2020; Mikroyannidis et al., 2020). That is, Blockchain is a list of records, called 'blocks' that are linked together to form a chain, and it can contain ledger entries, which are more commonly known as transactions (Chowdhury et al., 2020). In addition, Blockchain is managed by a decentralized community over a peer-to-peer (hereafter referred to as P2P) network and secured by cryptographic techniques (Kyun et al., 2021). What this means is that a Blockchain is copied and spread across a P2P network, instead of being

stored in a central location (Mikroyannidis et al., 2020). Also, it means that a block is added, using algorithms such as 'Proof of Work (hereafter referred to as POW)' and 'Proof of Stake (hereafter referred to as POS)' through a process of consensus among members of the P2P network (Hellwig et al., 2020; Karale and Khanuja, 2019). In a nutshell, Blockchain is a technology that enables the establishment of a shared system that guarantees 'security', 'immutability', 'reliability', and 'transparency' (Park, 2019). The details are as follows.

Security. The current centralized database system may inadvertently be exposed to the risk of hacking, whether it be due to internal staffs' mistakes or external hackers' attacks (Chowdhury et al., 2020). Once the central database system is hacked, all information can be leaked or lost. However, if organizations use Blockchain-based distributed ledgers, they will be able to permanently manage data free from the risk of hacking, unless all networks where the ledgers are stored are down (Kyun et al., 2021; Park et al., 2019).

Immutability. Immutability is one of the important aspect of Blockchain technology (Karale and Khanuja, 2019) and it is provided through a number of mechanisms, such as 'timestamp', 'consensus algorithms', and 'P2P network' (Mikroyannidis et al., 2020). Information or data stored in the form of a 'block' are added to the end of a 'chain', and whenever a new block is added, all computers on the network get updated (Ramachandran et al., 2020). Due to the nature of Blockchain, once a block inserted into the Blockchain network, it becomes permanent and can not be retroactively modified, not even by its author (Chowdhury et al., 2019). This im-

mutability of Blockchain makes entries in a distributed ledger trustworthy.

Reliability. The basis of Blockchain is a P2P network system which is fundamentally trust-based, so when trust is lost, it disappears (Park, 2019). As a result, all recorded data on Blockchain is highly reliable and moreover created by consensus of network users. Using the consensus algorithms, such as POW or POS, a Blockchain network guarantees reliability of the entire distributed system in an environment where distributed ledgers are difficult to ensure reliability among participants (Kyun et al., 2021).

Transparency. A Blockchain-based network is managed transparently, which means that anyone can access and use it for free (Park, 2019). All transactions and events on Blockchain can be accessed as long as he or she is a member of this Blockchain-based system. That is, all recorded data on the Blockchain-based system is transparently disclosed and managed by a decentralized P2P network. In short, once registered in this Blockchian-based system, the data is permanently stored and can be accessed by all participants (Kim, 2018; Kyun et al., 2021).

4.1.2 Smart Contracts

A smart contract is an IT technology that literally makes a contract smart. It is a concept proposed by Nick Jabo in 1997 (Yasunori, 2017) to automatically execute transactions without a need for intermediary (i.e., a third party) when the contract requirements are established on a Blockchain network (Hwang et al., 2020; Marjit and Kumar, 2020). That is, a smart contract is a technology that expands the use of Blockchain to the storage of transaction records, which allows

the automatic execution of a contract in accordance with conditions recorded on the Blockchain network. The use of these smart contracts makes numerous applications possible on Blockchain networks. As a simple example, an automatic recharge service with a credit card when the electronic money balance of a prepaid card is below a certain amount, is also a kind of smart contract (Nagato, 2018). In a nutshell, a smart contract is a self-executing programme embodied in Blockchain, which can reduce administrative efforts, save time and disagreement in transactions (Hwang et al., 2020; Lam and Dongol, 2020). Three major properties of such a smart contract, which are classified by Lam and Dongol, are as follows.

Autonomy. Transactions on Blockchain do not require a third party acting as an intermediary, reducing administrative efforts and also saving time (Lam and Dongol, 2020). In other words, the introduction of smart contracts eliminates the need for notarization by a third party, thereby improving the complex process of a transaction, reducing infrastructure cost, and saving time (Hwang et al., 2020).

Self-sufficiency. When all required conditions are fulfilled on a Blockchain network, a smart contract is automatically executed and results are stored in 'blocks'. Also, as the contract includes penalties, there is automatic enforcement of obligations (Marjit and Kumar, 2020).

Decentralization. A smart contract does not exist on a single server as it is distributed and self-executing across all computers on a Blockchain network (Lam and Dongol, 2020). And transaction records self-executed in a smart contract are also distributed and stored on the Blockchain network.

4.2 A Learner-Centered Liberal Arts Education Empowered by Blockchain Technology

Research and development in learner-centered learning or learner-centered educational environments is a major topic which has long been explored in the field of education. In this section, a decentralized learning platform empowered by Blockchain technology, is proposed to make 'a truly learner-centered educational environment' possible.

Though there has been tremendous improvement in the university liberal arts education in Korea with help of the current government-funded innovation projects, yet it still has some limitations as has been described in 3.4. In order to more actively develop liberal arts courses required by rapidly changing society and students' needs, there needs to be a more flexible and fundamentally innovative system. It may be possible if Blockchain technology, which are explained in previous section, is applied to current liberal arts education system.

In 4.2, it is suggested that a learner-centered liberal arts education system empowered by Blockchain technology will be used to solve the limitations of the current liberal arts education system. The details are as follows.

4.2.1 A Decentralized Liberal Arts Education Platform Empowered by Blockchain-Based Smart Contracts

Our approach to a decentralized learning platform operated by Blockchain-based smart
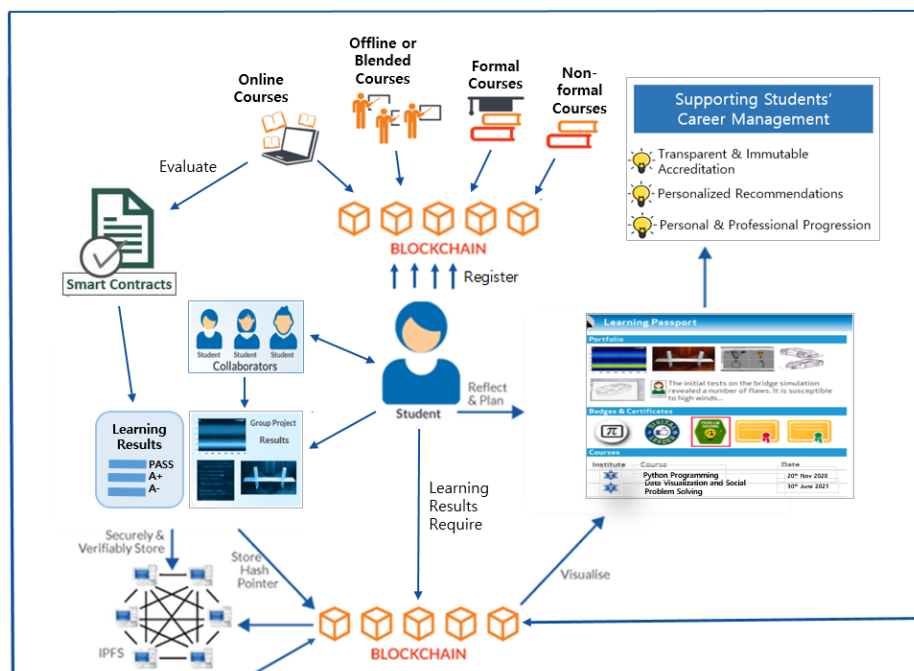
[Figure 2] A Decentralized Learning System using Blockchain-Based Smart Contracts: An adjusted example based on the figures from Mikroyannidis et al.(2018) & https://stayk9.tistory.com/123 (Accessed on Oct. 24, 2021)

contracts is shown in [Figure 2]. The proposed liberal arts education system is a network-centered platform based on the convergence of online and offline curricula. It is fundamentally designed, using Blockchain-based smart contracts. That means all courses including on- and off-line courses can be managed by the university's Blockchains and executed automatically when certain conditions are met. For examples, university instructors or professors from an 'expert pool (see 4.2.2)' could upload courses and set up tasks on the university's Blockchain for students. Depending on the course, a duration and a number of credits may vary. In certain cases, students are free to choose when to study within the allowed range. Students choose and register courses that are suitable for them, whether they may be online or convergence courses combining online and offline. Or, they may be either formal courses or non-formal courses. Also, depending on the aims and characteristics of a course, it may be either lecture-based or project-based. Therefore, students may be either studying on their own, collaborating with other students, or getting help from instructors. In any case, all learning histories are recorded on Blockchain along with their learning results.

When students register for a particular course and the requirements for course completion are met, each course could be automatically verified by smart contracts on Blockchain. Upon completion of all tasks, instructors, who provide courses on the liberal arts education Blockchains, are payed, depending to a number of enrolled students, and students are awarded credits. All liberal arts courses could be offered this way, based on Blockchain-based smart contracts.

Under this Blockchain-based system, certified experts from the university's 'expert pool (see 4.2.2)' can upload a particular course on Blockchain without any permission from university committees, and students can choose, register and study courses which they wish to study. If universities are using this Blockchain technology, when providing new courses that meet the demands of society and learners, they will be able to save unnecessary effort and time. Furthermore, this system allows students to study flexibly according to their circumstances. That is, the system solves the first limitation of the current liberal arts education innovation, mentioned in 3.4.1. If the courses on the Blockchain-based system provided by instructors or professors do not meet the social demands, students will not choose them. Courses that are not chosen by students will automatically disappear from the system. Regardless of whether experts are from either inside or outside universities, they know exactly what knowledge and skills are required by society. Also, students know very well what knowledge and skills they should acquire to manage their own career, and therefore can properly determine what courses they need. In fact, the third party intervention is not necessarily needed in many cases.

In addition, students' learning histories and outcomes are stored in blocks of the university's Blockchain, according to [Figure 2]. Thereby, whenever students need to use proof of their learning, they immediately can utilize it that is stored on Blockchain without the involvement of a third party, i.e., university administrative personnel. That is, students' 'learning passport (see 4.2.3)' can be automatically made based on their learning histories and outcomes stored in

university Blockchain, which can be used for their career managements.

4.2.2 Expert Pool

Our approach to transactions between instructors, courses, and students on the liberal arts educational system using Blockchain-based smart contracts is shown in [Figure 3]. As has been described earlier, the role of developing and teaching of new liberal arts courses is restricted to full-time faculty members. There may be several reasons why universities are adhering to this approach. However, if universities truly want innovation that contributes to the needs of society and students, they need more fundamental transformation and flexible operation on the new curriculum development. To achieve this, it is necessary to relax the qualification requirements for university course development and teaching, to inlcude experts in various related fields outside universities. At least, the college of liberal arts should seriously consider relaxing the requirements for rapid development and teaching of courses that are highly required by society. If

experts outside universities are actively involved in developing and teaching courses, then, there will be more courses that meet social demand and students' needs than what's now available in the current system. This is why an 'expert pool' is proposed to be created inside universities. This expert pool system can solve the second limitation of the current liberal arts education innovation, mentioned in 3.4.2.

As can be seen in [Figure 3], experts from a university expert pool are able to participate in developing and teaching courses in our proposed system. The courses developed by experts from either inside or outside universities are uploaded on Blockchain and offered to students. As explained in the previous section, if students do not choose a certain course on Blockchain, then, the course will automatically disappear. However, if students register for a particular course and meet the requirements for course completion, each course will be automatically verified by Blockchain's smart contracts. Upon completion of all tasks, instructors who provide courses are paid per a number of enrolled students. And students are
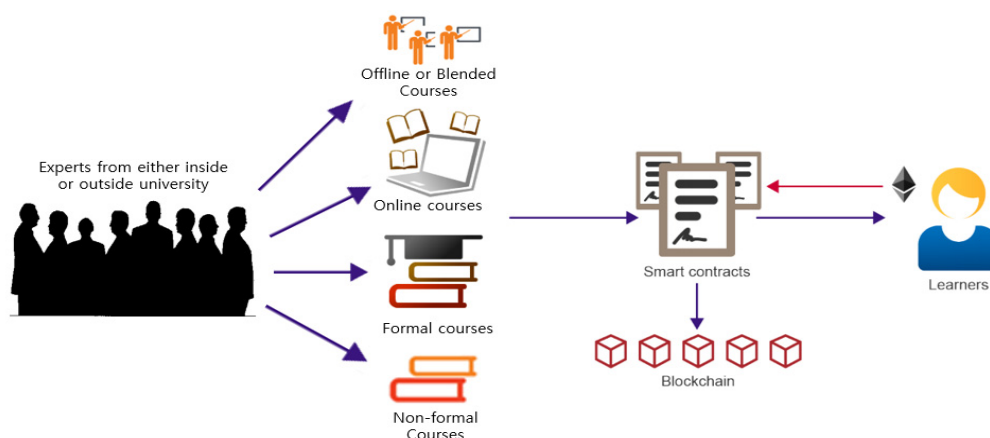
[Figure 3] A Simple Transaction between Courses, Instructors and Learners Based on Blockchain-based Smart Contracts : An adjusted example based on the figure from Mikroyannidis et al.(2020)

awarded credits.

If universities use this system empowered by Blockchain-based smart contracts, they will be able to realize a diversity of curricula and personalize students 'learning at the same time. Also, they may save the time and effort of university staffs, because this system does not need much involvement of a third party, i.e., university administrative personnel. Definitely, for this kind of expert pool system to work, the consensus between stakeholders should be preceded.

4.2.3 Learning Passport

A learning passport generated by a Blockchain-based liberal arts education system is shown in [Fig.4]. And it can be automatically generated on the web whenever students wish to issue, making easier for students to manage their own career. For example, learning passports can be usefully used as evidence outside universities, when students want to expand their knowledge and skills acquired from the university. Specifically, it can be useful when applying for some kinds of internship programs while in university or when starting a professional or academic career. Such trend is expected to increase into the future. Moreover, learning passports can be trustworthy because they are based on the students' records stored in distributed ledger on Blockchain: they are reliable, immutable, transparent and secure due to the nature of Blockchain (see 4.1.1). Ultimately, a learning passport system solves the third limitation of the current liberal arts education, mentioned in 3.4.3.

As in 4.2.2, the system that automatically generates students' learning passport helps universities to save time and effort of university

administrative personnel. Of course, in order for this kind of Blockchain-based smart contract system to work, there must first be a social consensus to be established.

[Figure 4] Example of a Learning Passport: An Adjusted Example Based on the Figure from Mikroyannidis et al.(2020)

5. Conclusion: Implications of and Future Prospects for the University Liberal Arts Education or College of Liberal Arts

The current study is aimed at investigating limitations of the current liberal art education innovation based on university innovation projects funded by the Korean government, and proposing a Blockchain based system, which helps overcome those limitations.

The proposed liberal art education system in this study is '*a network-centered education platform based on the convergence of online and offline courses*' which are operated by Blockchain-based smart contracts (see [Figure 2]). Besides, as part of this system, '*expert pool*'

consisted of experts inside or outside universities (see [Figure 3]) and 'learning passport system' (see [Figure 4]) were also proposed.

As our society is rapidly changing day by day, in order to meet the rapidly changing educational needs of society, universities should i) run the essential courses timely, ii) evaluate students' learning outcome fairly, and iii) enable students to use their learning proofs immediately. The Blockchain-based smart contract system, which is proposed in this study, allows the universities carry out these tasks efficiently. In other words, the education system empowered by Blockchain-based smart contracts enables students i) effectively perform personalized learning that they wish, ii) acquire learning results fairly, and iii) use those results as evidence for career management. Moreover, instructors or professors can timely provide courses on Blockchain without complicated and long processes, and get rewarded according to a number of students enrolled in their courses. Furthermore, university authorities can not only effectively perform curriculum quality management, but also save time and effort of the university staffs. Besides, due to the nature of Blockchain, all transactions on this Blockchain-based liberal art education system are secure, immutable, reliable, and transparent (see 4.1).

On one hand, we believe that the proposed liberal art education system in this paper may be a realistic alternative to university education innovation in the context of Korea, transcending beyond the innovation of liberal arts education. This is because the college of liberal arts is relatively a flexible department on campus. Therefore 'liberal arts education' or 'college of liberal arts' can be used as a kind of test bed

in preparation for future universities. That is, if the system proposed in this study, i.e., 'a network-centered educational platform operated by Blockchain-based smart contracts', 'experts pool', and 'learning passport', becomes successful in liberal arts education, it will be applied to other related systems on campus.

On the other hand, the identity and function of a college of liberal arts needs to be changed with change of time. Currently, even though a number of researchers are exploring the new identity of liberal arts education and also universities are reorganizing liberal arts education programs according to the research outcomes, more fundamental and structural transformations are required in order for universities to survive as sustainable institutions in the future.

Specifically, we should seriously consider to open 'liberal arts educational courses' to lifelong learners as well as university students in their twenties. Currently, for the target of lifelong learners, universities establish and operate 'lifelong learning institutes' or various types of 'special graduate schools' on campus. However, the threshold of universities needs to be even lowered in order to fundamentally attract lifelong learners to universities, which is perfectly possible with the proposed liberal arts educational system in this paper. A detailed description of this is as follows.

The future society is not only a highly technology-based society, but also a lifelong learning society in which lifelong learners must learn knowledge and skills required by new jobs throughout their life time (Chae et al., 2021). If there is a university system that allows lifelong-learners to complete the curriculum

required by their jobs or careers through liberal arts education, many lifelong learners will be likely to consider enrolling in these universities' liberal arts education courses. Furthermore, if there is a university system that allows lifelong-learners, who wish to acquire more knowledge and skills after completing a liberal arts course, to start the university degree programs, many lifelong-learners may naturally consider re-entering universities.

In fact, some advanced universities abroad, such as OUUK, i.e., Open university of UK (OUUK, 2021) and Woolf university (Woolf University, 2021) already have similar systems. OUUK is constantly researching and executing the educational system for lifelong- learners in a rapidly changing society, as well as the educational applications of new technologies including Blockchain. Woolf university is a Blockchain-based higher educational institution most recently founded in 2019 by Oxford university academics for the target of lifelong-learners.

In a nutshell, the fundamental innovation of liberal arts education and structural reformation of colleges of liberal arts, which are necessarily accompanied by transformation of the university system and the introduction of new technologies, will greatly contribute to not only the innovation of the college of liberal arts, but also the fundamental innovation of the entire university.

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