# Development of Students' Digital Capability under the Context of New Liberal Arts Construction

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**Abstract:** The construction of the new liberal arts puts forward new requirements and expectations for the training of liberal arts students. This paper demonstrates the importance of enhancing students' digital capability in the context of new liberal arts construction in our country, and discusses the three challenges that liberal arts students face in improving their digital ability, namely, poor grasp of mathematics, self-psychological exclusion, and lack of opportunities for digital ability and communication. Based on this, this paper puts forward three measures to promote the basic ability of mathematics, the psychological construction of mathematics learning, and the digital resource system of arts, in order to provide reference basis for promoting the construction of new liberal arts.

**Keywords:** Digital capability; New liberal arts; Digital resource allocation.

## 1. Introduction

Rapid advances in digital and interconnected technologies have given rise to vast amounts of structured and unstructured data. People are both data producers and data users, and the improvement of individual digital capability is especially important. Fan Hailin, the director of China Academic Degrees & Graduate Education Development Center has declared that higher education has been universalized. The transformation and promotion of higher education from quantitative to qualitative requires the formation of first-class undergraduate major groups covering a wide range of disciplines, with both the advanced level of the world and Chinese characteristics. Meanwhile, the innovative construction of engineering, medicine, agriculture, and liberal arts through the promotion of disciplines, is known simply as the "four new" constructions.

With the release of the "New Liberal Arts Construction Manifesto", the goal of the construction of new liberal arts is made clear in terms of both requirements and objectives. First, in terms of requirements, the development of liberal arts education needs to be adapted to the requirements of the new era as soon as possible; and emphasis is placed on cross-integration of different types, including within and between disciplines and with new technologies and industries. Second, in terms of goals, we should focus on cultivating talents and disciplines, strengthen the construction of new liberal arts disciplines, and train outstanding social scientists.

Talent cultivation is the key to realize the goal of discipline construction, and the cultivation of outstanding liberal arts students is the cornerstone. Although the goal of the new liberal arts development is clear, its implementation is still in the exploration stage. It is not clear how to focus on the ability of students in the context of "new liberal arts" construction. Wang and Liu believe that the key to talent cultivation in the construction of new liberal arts rests in the development of "digital humanities", that is, to improve students "digital capability" as the baseline and goal. In order to meet the existential challenges posed by the explosion of information, big data, artificial intelligence and other technologies in today's society, to upgrade and broaden the career path of liberal arts students, to strengthen interdisciplinary academic exchanges and cooperation, and to improve their ability to use digital network resources for autonomous learning, it is essential to improve the digital ability of liberal arts students. In fact, digital capability has become a necessary ability for university students to participate in social life, undertake independent study and study for life. However, the improvement of digital ability of liberal arts students can not be accomplished overnight, it requires years and years of long-term investment, both in time and effort, and for the liberal arts students relatively lacking of digital ability, it is difficult to find an effective way to improve digital capability. Therefore, in the context of the "new liberal arts, " how to improve the digital capabilities of liberal arts students? What are the challenges in developing students' digital skills? How to deal with it in the process of cultivating talents?

According to Zhou and Li, the meaning of the new liberal arts is twofold. First, it emphasizes the updating of the subject content and teaching mode, and aims to meet the needs of the world's scientific and technological development and social development. Secondly, it emphasizes the cross-integration of discipline construction, on the one hand, to explore the new boundaries of liberal arts research boldly, to expand the scope of liberal arts research, to realize the integration of different disciplines within the liberal arts, to break the boundaries

of curriculum forms, disciplines and the self-restraint of the original curriculum system of disciplines; On the other hand, it is necessary to break the boundary between the liberal arts and other major disciplines to achieve a larger quantitative and qualitative integration. On this basis, three new features of new liberal arts have been summed up. (1) The intersection of new discipline, which s is not only within the traditional humanities and social sciences such as literature, history, politics, economics and philosophy, but also in the humanities and social sciences and other disciplines. (2) The carrying of new functions, that is, the development of new liberal arts is not only the dissemination of knowledge, but also guided by the cultivation of cultural self-confidence and the ability to discover the unique cultural values of our country in different disciplines and fields. (3) The practice of the new path, which emphasizes the improvement of the quality of liberal arts students' training, mainly reflected in two aspects: the consolidation of traditional professional skills to meet the needs of the liberal arts industry, and taking into account the new needs in the future, preposition the new needs for talent training, especially the investment for specific aspects of talent, and raising the quality threshold for talent training.

To sum, the improvement of digital ability of college liberal arts students has become an important link in the background of "new liberal arts". The European Union pioneered the concept of ''digital capability'' in the early 21st century, and firmly believes that the development of digital talents is the breakthrough point to improve national competitiveness, achieve sustained economic growth and solve employment problems. "Research on the Connotation of Citizen Digital Literacy" makes a detailed introduction to the connotation of digital capability. With the popularity of 5G digital technologies and social networks, digital tools and media are playing an increasingly important role in people's work, study and lives. The digital ability of citizens is crucial and has become an inherent and rigid need for innovative talent development.

## 2. Digital Capability and Related Concept

2.1 Definition of Digital Capability

Digital capability is the ability to work, communicate, live and entertain confidently and critically using information technology. Mingxuan</author><author>Feng, Xueqing</author></authors></contributors><titles><title>The Current Situation and Optimization Strategies of Digital Educational Resources Supply in my country</title><secondary-title>Audio-visual Education Research</secondary-title></titles><periodical><full-title>Audio-visual Education Research</full-title></periodical><pages>7</pages><volume>41</volume><number>6</number><dates><year>2020</year></dates><urls></urls></record></Cite></EndNote> This study defines the digital capability of college students as a comprehensive basic ability for students in the digital age. It includes the following four levels: (1) Basic digital capability, focusing on the level of knowledge skills, embodied in thinking skills development based on traditional math knowledge, including basic math learning, digital ethics, basic thinking, software skills, and security awareness development. (2) Digital learning capability, which emphasises the ability to self-improve through the use of digital resources and knowledge, including inquiring skills, critical thinking skills, writing learning skills under digital technology, and the ability to self-learn in accordance with learning objectives. (3) Digital thinking capability, which refers to the ability to analyze and make decisions utilizing logic and reasoning skills during the digital information processing process, and (4) digital innovation capability, which refers to the ability to utilize digital technology and instruments for innovative research and practical problem-solving. It emphasizes the application of digital technology and tools to innovation, necessitates innovative thought and practical skills, and incorporates the ability to comprehend the most recent digital technology development patterns.

2.2 Definition of Digital Literacy

The American Library Association defines digital literacy as the use of information and communication technologies to retrieve, understand, evaluate, communicate, use and recreate relevant digital information, and the matching level of awareness of values, attitudes, responsibilities, digital ethics and security. The same can be said of Wang Youmagnesium and others who generalize about digital literacy, the ability to confidently and creatively use information, communication and digital technologies to participate in learning, work, vocational training, and so on. At the same time, scholars have compared the concepts of digital, information, media, and cyber literacy. Digital literacy is an evolving concept that should be comprehensive, open, and dynamic.

2.3 The relationship between digital capability and literacy

Digital literacy and digital capability are closely related and there is a close relationship between them. Both refer to a range of skills and knowledge that people should have in the digital age, but they differ in focus and scope. Digital capabilities emphasize the ability to

access, process, analyze, and apply information from the digital environment, as well as the processing and innovation of digital information. Digital literacy is a more comprehensive concept that includes not only digital capabilities, but also digital awareness, ethics, security, responsibility, attitudes, and critical thinking.

## 3. Issues of Developing Students' Digital Capability under New Liberal Arts Building

3.1 Insufficient mathematical understanding

Many students who major in liberal arts are generally weaker in digital skills and mathematics, which can make it challenging to solve some digital-related problems. However, this does not mean that all liberal arts majors lack these skills. There are three main reasons why the mastery of mathematics is not strong enough for liberal arts students: (1) In curriculum development, liberal arts majors tend to focus more on language, history, philosophy, and so on, and less on math and statistics related to digital skills, and thus lack opportunities to improve their digital skills. (2) In terms of interest preferences, some liberal arts students may not be interested in digital and math courses, resulting in their relative weakness in this area. (3) In terms of their academic foundation upon admittance, liberal arts students may have taken non-math related courses in high school, leading to a lack of math basics.

3.2 Self-psychological resistance

Some liberal arts majors may have an aversion to digital skills. There are three main reasons: first, cognitive bias towards digital capability leads them to assume that the improvement of digital capability has nothing to do with their major, and they are therefore reluctant to spend time and energy on developing and upgrading their digital ability; Second, the collapse of confidence caused by past setbacks, such as the experience of being unable to learn math related subjects no matter how hard you try in high school, leads to a collapse of confidence, which in turn leads to a fear of digital skills development and, ultimately, self-rejection; Third, students have deviations from self-learning orientation because they do not understand social needs. For example, students who think they are good at majoring in the arts, not math, prematurely form a psychological orientation that they are gifted in the former.

3.3 Lack of opportunities for applying and communicating digital skills

Liberal arts disciplines typically involve a large amount of literary data and information collections, such as historical documents, philosophical works, and literary works. Thus, research in liberal arts often involves extensive unstructured data organization, classification, and retrieval. The usage of digital technology can increase researchers' efficiency in organizing and managing these data and information. While students majoring in liberal arts usually lack opportunities to apply digital technology to problem-solving and communication, which may hinder the development of their digital skills, in part because academic resources are skewed toward science, technology, engineering and math (STEM) engineering disciplines, influenced by educational orientation, economic development needs, academic evaluation systems, and allocation of research funding. The reasons for the lack of digital capability applications and communication opportunities can be summarized in three ways: Firstly, the digital hardware resources in universities tend to favor STEM disciplines. In general, liberal arts students do not have access to laboratories similar to those in STEM fields. They also lack experimental labs such as "language labs" and "psychology labs" that provide experimental learning opportunities. Actually, according to prior research, STEM students have a significantly higher per capita availability of laboratory resources compared to liberal arts students. Secondly, the cultivation period for digital capabilities in liberal arts students is longer. Unlike STEM fields, digital capabilities in liberal arts require a stronger connection and mapping to social practices. It involves iterative leaps and summarizing experiences through theoretical and practical integration, with improved cognitive abilities usually being directly proportional to time and experience. Thirdly, there is a lack of training courses specifically focused on digital technology and software training for liberal arts students. Typically, universities do not differentiate between liberal arts and STEM students in terms of digital technology and software training. It is assumed that the former ones possess the same foundational digital capabilities as STEM students, and academic training programs or practical projects mainly cater to the familiar scenarios of STEM fields.  This often results in a disconnect between the learning of digital technology and software skills and the practical requirements of liberal arts research, making it challenging to directly apply acquired knowledge to academic research in liberal arts.

## 4. Developing Students' Digital Capability under New Liberal Arts Disciplines Building

4.1 Targeted improvement of mathematical foundation skills

Basic mathematical skills is the basis for improving digital capabilities, as they are the core component of digital capabilities and starting point for improving digital capabilities. The development of basic mathematical capabilities can contribute to the improvement of

"basic digital capabilities" and thus to the development of digital learning, thinking and innovation capabilities. The following measures can be taken: First, identifying the learning goals of students and providing detailed and feasible programs to enhance their digital abilities. In the face of the vast amount of mathematical knowledge, liberal arts students should not be able to cover everything, but should insist on the most relevant knowledge. And we should take advantage of the "two-eight principle" in time management, that is, 80% of the time is invested in 20% of the knowledge points to dig deeper. Specifically, it is necessary to seek help from students and teachers with successful experiences. Experienced students and teachers can tailor the essence points to improve digital capabilities for students with different research directions, thus, helping them with "fewer detours" and "stepping on potholes"; Second, it needs to strengthen the resource support of university libraries for students majoring in liberal arts. As an important place of knowledge storage and communications in universities, libraries should adopt digital software training for professional digital training for liberal arts students. Liberal arts students mainly concentrated on the adaptation and application of existing modular computing models and the adaptation and improvement of existing algorithms. The library should provide mainstream databases, popular analysis software (e.g., Stata, Python, SPSS, SQL, Java, etc.) and corresponding electronic learning materials and videos (e.g., UCLA's free data analysis learning website) that can be packaged for download; Third, it needs to improve the library's service capacity targeted at liberal arts students, which emphasize the importance role of library managers in data analysis and resource management. By enhancing the digital capability of such personnel (i.e., library managers), it can provide data analysis services and document processing services for liberal arts research and realize the deep embedding of disciplinary services into the research process of liberal arts scholars ; Fourth, we need to offer courses on relevant mathematical fundamentals (e.g., statistics, logic, etc.) for academic and practical scenarios of liberal arts students. The enhancement of the digital capability of liberal arts students needs to be accompanied by the enhancement of cognitive level, and practice is the basis for enhancing cognitive level. In order to improve their digital capability-related cognitive level, we could set up courses that are more targeted to the needs of liberal arts students in writing academic papers. By encouraging students to participate in school-level data analysis research projects, as well as relevant provincial and national competitions (e.g., Challenge Cup, National Student Mathematical Modeling Competition, etc.), students can stimulate their interest in learning and cultivate clear learning objectives in the competitions. In addition, the students will be able to design their own learning content and solve problems for a specific data analysis problem.

4.2 Psychological construction of mathematics learning

Prior research has shown that the process of improving digital ability is a process of improving mathematical cognition and an emotionally constructed process of engaging in mathematical learning activities, thus attention must be paid to students' psychological changes and related psychological construction. Therefore, in order to improve the math learning ability of liberal arts students, and then improve their digital ability, it is necessary to adopt corresponding psychological construction measures to help students to unblock the psychological obstacles they encounter in learning math and build an enterprising mentality. The main initiatives include the following three: First, to help students understand the relationship between math and other liberal arts studies, and to correct their cognitive bias in math learning. The most fundamental cause of cognitive bias is limited cognitive ability and is strongly influenced by the environment in which it occurs. Most liberal arts students, for example, do not know that most liberal arts and math majors fall under the umbrella of philosophy, which requires a high level of logical reasoning skills, so improving digital skills can help improve the logical thinking and analytical skills of liberal arts majors. The teacher should understand the reasons for the students' biases with mutual respect, and then patiently guide the students to the correct perceptions and correct their biases through repeated and patient teaching. Secondly, it is important to help students build their self-confidence in learning mathematics. We can bring in psychologists to study how liberal arts students build self-confidence in maths and to solve problems in this area through a mix of unified counselling and individual improvement. At the same time, teachers should use more praise and encouragement to make students realize that they are valuable in learning mathematics, and use practical examples to explain mathematical concepts with real-life examples so that liberal arts students can more easily understand the application of mathematics in their daily lives and thus stimulate their interest in learning. Students should also be taught various learning skills, such as goal orientation, problem-solving prioritization strategies, time management, and self-assessment techniques, to enhance their ability to manage, self-evaluate, and learn independently. Finally, we should use kinds of channels to make liberal arts students aware of society's demands and reality. The data age has brought new challenges to the careers that liberal arts students have traditionally chosen, and the real direction of society's demand for talents is a mix of liberal arts background knowledge and certain digital skills. We can use special lectures, career planning training, school-enterprise cooperation, and practical activities to invite experts, graduated students, corporate executives,

and career planners to train students and teach them the truth about society's needs to strengthen students' cognition of society's real demand. What's more, in terms of academic guidance, an academic mentor system can be set up to give professional advice and planning to liberal arts students. This will help them understand their strengths, figure out their academic potential early on, and find a triage to set a good direction for their development.

4.3 Targeted resources allocation

With the need of digital age and "new liberal arts' 'construction, our country is increasing the digital resources for liberal arts subjects, which is helpful to improve the digital ability of liberal arts students and cultivate outstanding liberal arts talents. There are three main ways to promote digital resources for liberal arts students and the early formation of interest points: first, building a "laboratory" or "laboratory building" for liberal arts, like those for science and technology. And psychology is ahead of other liberal arts and has set an example for other disciplines to follow. In fact, the characteristics of the field of psychology and the wide use of experimental methods in psychology research led to the creation and growth of psychology labs. With the help of big data technology, 5G technology, field experiments, natural experiments, and other "quasi-experimental" methods, researchers can look into cause-and-effect relationships and how they are used in different liberal arts disciplines. As the saying goes, "No experiment, no cause and effect; no experiment, no data". Therefore, universities should build relevant laboratories for different liberal arts disciplines to promote the improvement of students' digital ability.

Secondly, we should teach liberal arts students how to think, use a "project-based" method of teaching, strengthen the link between abstract theories and social phenomena in liberal arts fields, and help liberal arts students see the difference between "social phenomena," "abstract theories," and "objective data". if liberal arts students deal with unstructured textual information every day, they will face a high threshold of data analysis entry (e.g., text sentiment analysis, content analysis), which won't help them quickly develop an interest in learning digital skills. Liberal arts students' digital capability depends on how well they improve their cognitive skills for social practice. Project-based learning lets them learn earlier about the specific needs of the real world. At the same time, it is important to build "bridges" and increase the "frequency of communication" to help students better understand how theory and reality fit together. The project-based curriculum and repetitive thinking training can help students improve their cognitive skills in the use of digital skills.

Finally, an integrated digital humanities service platform is set up in the school, and the task is released in the form of a crowdfunding + audit project. The platform is designed to help liberal arts students solve problems that cannot be solved on their own, usually in the process of developing their own digital capability, and to publish them in the form of paid tasks to promote the efficiency of problem solving. At the same time, we can make it easier for people from different fields to talk to each other and help disciplines within and outside of the new liberal arts cross-pollinate. For example, The platform welcomes computer science, science, and engineering majors. To create a virtuous cycle in its bilateral market, the platform must heavily subsidise task posters and bidders.

## 5.Conclusion

Based on the fact that the state vigorously promotes the development of "new liberal arts" in higher education, this paper believes that improving liberal arts students' digital ability is the "grasp" and "prerequisite" for the development of "new liberal arts". It is also a means of addressing the challenges of today's rapidly changing society. The development of students' digital ability, on the other hand, places a high demand on their basic digital ability, digital learning ability, digital thinking ability, and digital innovation ability. At the moment, Chinese liberal arts students' digital ability is in the middle of the world, and students generally face issues such as a lack of basic mathematical knowledge, self-psychological rejection, and a lack of opportunities to communicate with applied digital ability. As a result, this paper proposes addressing this challenge through strategies such as "targeted improvement of mathematical foundation skills", "psychological construction of mathematics learning" and "targeted resources allocation". The strategies outlined above aim to keep liberal arts students from becoming "islands" of information as they develop their digital abilities, to promote cross-fertilization within and outside of disciplines, and to contribute to a new liberal arts construction with Chinese characteristics.

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