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PAPER

A Study of the Impact of the Application of Digital Technology-Integrated Entrepreneurship Education on Entrepreneurship and Entrepreneurial Performance

Hsin-Ming Hsieh, Alex Maritz(✉)

La Trobe Business School, La Trobe University, Melbourne, Australia

a.maritz@latrobe.edu.au

ABSTRACT

Under the condition of a perfect digital technology environment, teachers receive richer teaching resources to enhance their teaching ability, improve their teaching quality, and enrich their teaching content. Teachers teaching with computers could enhance students' learning motivation, reinforce peer cooperation, train students' autonomy, and enhance students' subject learning ability. Delivering vivid sounds and pictures through multimedia-assisted teaching could induce students' learning interests and further promote learning effectiveness. Using an experimental design model for the experimental research, 206 college students in Taiwan Province, as the experimental objects, are preceded by the 16-week (total 48 hours) digital technology-integrated entrepreneurship education experiment. Research findings show the following: 1. Teachers, according to students' learning satisfaction, check students' learning effectiveness to ensure teaching quality and timely modify teaching styles to better match students' learning needs. The benign interaction could largely assist in the improvement of the entire educational environment. 2. The application of digital technology in integrated entrepreneurship education reveals significantly positive effects on entrepreneurship and entrepreneurial performance. According to the results of the proposed discussions, it is expected to acquire more information about entrepreneurship education and its relevance in order to provide entrepreneurship education and the related promotion units and people with practice directions and suggestions for practicable and proper entrepreneurship education in order to effectively implement the ideal and objective of entrepreneurship education.

KEYWORDS

digital technology, entrepreneurship education, entrepreneurship, entrepreneurial performance

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1 INTRODUCTION

Under the perfect digital technology environment, teachers receive richer teaching resources to apply various teaching systems and network platforms or different teaching styles with mobile devices in teaching sites to enhance their teaching ability, improve their teaching quality, and enrich their teaching content. It has become a teaching trend among modern teachers. Along with the approach of the knowledge economy era, the global economic structure is encountering deconstruction and restructuring. The demands for innovative and entrepreneurial talents reveal the importance of entrepreneurship [1]. Along with the emergence of entrepreneurial economic systems, both nations and enterprises need to enhance their competitiveness through knowledge innovation. People, due to their gradual understanding of entrepreneurship, start to develop personal potential and realize their ego ideals through entrepreneurship. Entrepreneurship is generally linked to business. The development of higher education is a factor in facilitating entrepreneurial opportunities for people. A higher education institution is an academic palace to pursue knowledge and an important place to cultivate professionals. Higher education developed from elite education to popularization and universalization and expanded from liberal arts education to pragmatic education so that learners could select and learn the desired knowledge in multiple knowledge fields to create opportunities to realize businesses. Higher education has been the source of sustainable development and competitiveness promotion in a nation. Nevertheless, in the knowledge economy, the status and function of higher education are facing new impacts and challenges. Universities do not simply engage in research but have to promote entrepreneurship education to cultivate the innovative and entrepreneurial talents required in society. Entrepreneurship could be cultivated, and entrepreneurial attitudes could be learned. Entrepreneurship education and the learning of relevant activities could enhance the possibility of successful entrepreneurship. Higher education is the major institution for cultivating senior talents. In the learning process, a school should provide learners with channels to contact real society, rather than ideal or theoretical learning [2]. Having learners, through entrepreneurship education and relevant activities, learn to organize a company and the professional contents of product development, market analysis and positioning, fundraising and management, and business running before getting into society could cultivate potential entrepreneurs and reduce the risk of failure. For this reason, the effects of the application of digital technology integrated into entrepreneurship education on entrepreneurship and entrepreneurial performance are discussed in this study. We expect to acquire more information about entrepreneurship education and provide entrepreneurship education and the relevant promotion units with practice directions for practicable and appropriate entrepreneurship education and the relevant activities to effectively implement the ideal and objective of entrepreneurship education.

2 LITERATURE REVIEW

An entrepreneurship teaching style generally contains case studies, lectures, and required readings, aiming to develop students' critical thinking and information analysis [3]. Brann et al. [4] indicated that real-life case studies often appeared in enterprise education courses. Other entrepreneurship management education-related activities covered entrepreneurship competitions, entrepreneurship clubs,

entrepreneurship seminars, and entrepreneurship internships. Traditional entrepreneurship teaching styles focused on class presentation, with a teacher leading the content and progress of teaching activities and inculcating knowledge and concepts with systems and structure in students. Students, on the other hand, passively and comprehensively accepted the teachers' guides and followed course instructions to complete assigned homework. Traditional teaching styles were therefore teacher-centered. Teachers' one-way class lecturing could easily lack training for students' thinking and judgment, and most course materials were theories, which could not easily cultivate students' knowledge application to solve actual problems. Traditional didactic instruction was lacking in communication and interaction channels between teachers and learners, so the knowledge delivered could not be integrated with students' learning willingness and schedule [5]. Abdullah et al. [6] regarded students' learning as the teaching objective for which teachers had to change concepts and methods, and students' learning effects should be the major objective of the concepts. Mohammed et al. [7] considered that foreign schools extremely emphasized integrated and practical courses, stressed teaching different from traditional didactic instruction, and broadly combined various resources and practical lesson plans with digital technologies, such as case studies, lectures, simulations, and internships.

Teaching media became multiple along with the development of digital technology, from paper-based materials to streamlined media. In addition to rich learning contents and presentation styles, new learning interactions enhance the learning effect through multisensory stimulation. Bernacki et al. [8] revealed that the presentation of different digital technology media would affect learning effects, and adding text meaning and relevant pictures to teaching contents would help learning. Gómez-García et al. [9] indicated that hypermedia assisted in learning activities with visual function, quantitative trait, and sound to enhance students linking of images, ideas, and meaning through hypermedia and achieve the organization of long-term memory. Chen et al. [10] indicated in their research on applying technologies to teaching activities that the application of computer technology could actually promote learner motivation and enhance learning control ability. The application of technology to teaching activity was indeed worth development and application in teaching activities. Wagenseil [11] mentioned that digital learning contents would not change due to distinct media or standards so that learners could easily operate and learn, breakthrough limits to time and space, and fully learn for successful learning. Learning motivation allowed students to prepare for learning as well as enhance their attention and absorption of new knowledge; students with strong learning motivation showed better preparation for learning than those with weak motivation [12]. The following hypotheses are therefore proposed in this study:

H1: Digital technology-integrated entrepreneurship education presents more positive effects on entrepreneurship than traditional entrepreneurship teaching.
H2: Digital technology-integrated entrepreneurship education shows more positive effects on entrepreneurial performance than traditional entrepreneurship teaching.

Lu et al. [13] indicated that entrepreneurial performance could not be measured with general business management measurement methods, as entrepreneurship could dig and use opportunities to create profits. In this case, in addition to the consideration of economic performance, individual effort toward social contribution

should be included. Regarding the connection between entrepreneurship and entrepreneurial performance, many studies have pointed out that entrepreneurship is the core factor in the success of entrepreneurship [14]. An entrepreneur's entrepreneurship refers to the traits of autonomy, innovation, risk-taking, precaution, and competitive aggressiveness. Innovation refers to an entrepreneur's being able to continuously innovate in competitive markets to assist in product sales and growth and have positive effects on entrepreneurial performance. Risk-taking refers to an entrepreneur's being brave enough to grasp the opportunities in the environment and being willing to invest certain resources in their pursuit; it is an inevitable factor in achieving entrepreneurial performance. Precaution stands for an entrepreneur being able to predict changes in the environment and think positively about how to face and cope with them in advance. Competitive aggressiveness refers to a competitive attitude or active response to opponents' attempts to win. Sukendro et al. [15] explained that, as there were huge changes in the entrepreneurship process, precaution could help an entrepreneur make adjustments to cope with environmental changes and assist an entrepreneur in achieving the expected entrepreneurial performance. An entrepreneur's autonomy could assist in solving uncertain problems in entrepreneurship with creative methods without following old rules [16]. Under such premises, entrepreneurship presented positive assistance in entrepreneurial performance. Accordingly, the following hypotheses are proposed in this study:

H3: Entrepreneurship reveals significant and positive effects on economic performance.
H4: Entrepreneurship appears to have remarkable and positive effects on non-economic performance.

3 RESEARCH OBJECT AND METHOD

3.1 Measurement of research variable

Entrepreneurship. Referring to Huang et al. [17], autonomy, innovation, risk-taking, precaution, and competitive aggressiveness are used as the dimensions to define entrepreneurship in this study, as illustrated in Table 1.

Table 1. Measurement of entrepreneurship

Dimension	Definition
autonomy	Referring to an individual or a group presenting independent and self-directed ability or willingness in the pursuit of opportunities.
innovation	Based on objective innovation to create new satisfaction or new consumer need.
risk taking	New entry behavior is an important trait of entrepreneurship. In this case, engaging in new entry behavior has to take higher risks. An entrepreneur being willing to take risks for grasping opportunities that it is the level of an individual being willing to take risks.
precaution	To predict changes of needs in future market and the hidden opportunities as well as to take actions earlier than competitors to reinforce personal competitive advantages.
competitive aggressiveness	Being willing to challenge competitors in order to win the industry. Competitive aggressiveness stresses on the interaction among existing competitors in the market.

Entrepreneurial performance. Referring to Zhang et al. [18], economic and non-economic indicators are defined to measure entrepreneurial performance in this study, as illustrated in Table 2.

Table 2. Measurement of entrepreneurship performance

Dimension	Definition
economic performance	Mainly financial performance and growth as the indicators.
non-economic performance	Entrepreneur's subjective satisfactory and perception.

3.2 Research object and sampling data

An experimental design (nonequivalent pretest-posttest control group design) is used for the experimental research. Taking 206 college students in Taiwan Province as the experimental subjects, the 16-week (total of 48 sessions) digital technology-integrated entrepreneurship education is preceded. Two classes, the experimental classes (103 students), are taught with digital technology-integrated entrepreneurship education, and another two control classes (103 students) remain traditional didactic entrepreneurship teaching. SPSS is utilized for analyzing the data, and factor analysis, reliability analysis, regression analysis, and analysis of variance are applied to test hypotheses.

3.3 Analysis method

Analysis of variance is applied to discuss the difference between digital technology-integrated entrepreneurship education and entrepreneurial performance, and regression analysis is further used to understand the relations between entrepreneurship and entrepreneurial performance.

4 RESULT ANALYSIS

4.1 Reliability and validity analysis

Entrepreneurship. With factor analysis, entrepreneurship in this study is extracted from five factors: "autonomy" (eigenvalue = 3.152, $\alpha = 0.83$), "innovation" (eigenvalue = 2.621, $\alpha = 0.85$), "risk taking" (eigenvalue = 2.275, $\alpha = 0.86$), "precaution" (eigenvalue = 1.752, $\alpha = 0.88$), and "competitive aggressiveness" (eigenvalue = 1.381, $\alpha = 0.84$). The cumulative covariance explained achieves 85.183% (see Table 3).

Table 3. Analysis of entrepreneurship reliability and validity

Dimension	Eigenvalue	α	Cumulative Variance Explained
autonomy	3.152	0.83	32.582%
innovation	2.621	0.85	51.756%
risk taking	2.275	0.86	66.495%
precaution	1.752	0.88	77.214%
competitive aggressiveness	1.381	0.84	85.183%

Entrepreneurial performance. Entrepreneurial performance, through factor analysis, is extracted into two factors: "economic performance" (eigenvalue = 3.751, α = 0.90) and "non-economic performance" (eigenvalue = 4.266, α = 0.92). The cumulative covariance explained reaches 87.253% (see Table 4).

Table 4. Analysis of entrepreneurial performance reliability and validity

Dimension	Eigenvalue	α	Cumulative Variance Explained
economic performance	3.751	0.90	36.588%
non-economic performance	4.266	0.92	87.253%

4.2 Effects of digital technology-integrated entrepreneurship education on entrepreneurship and entrepreneurial performance

Variance analysis of digital technology-integrated entrepreneurship education in entrepreneurship. According to an analysis of variance to discuss the differences in digital technology-integrated entrepreneurship education in entrepreneurship, Table 5 reveals notable differences in digital technology-integrated entrepreneurship education in autonomy, innovation, risk-taking, precaution, and competitive aggressiveness in entrepreneurship.

Table 5. Variance analysis of digital technology-integrated entrepreneurship education in entrepreneurship

Variable		F	P	Scheffe Post Hoc
digital technology integrated entrepreneurship education	autonomy	11.862	0.000**	digital technology-integrated entrepreneurship education > traditional entrepreneurship teaching
	innovation	21.384	0.000**	digital technology-integrated entrepreneurship education > traditional entrepreneurship teaching
	risk taking	15.621	0.000**	digital technology-integrated entrepreneurship education > traditional entrepreneurship teaching
	precaution	17.596	0.000**	digital technology-integrated entrepreneurship education > traditional entrepreneurship teaching
	competitive aggressiveness	14.288	0.000**	digital technology-integrated entrepreneurship education > traditional entrepreneurship teaching

Note: **stands for $p < 0.01$.

From Figure 1, digital technology-integrated entrepreneurship education reveals significantly higher differences (3.86) in autonomy than traditional entrepreneurship teaching (3.24). Digital technology-integrated entrepreneurship education presents remarkably higher differences (3.74) in innovation than traditional entrepreneurship teaching (3.37). Digital technology-integrated entrepreneurship education shows notably higher differences (4.05) in risk-taking than traditional entrepreneurship teaching (3.46). Digital technology-integrated entrepreneurship education appears to have notably higher significant differences (3.57) in precaution than traditional entrepreneurship teaching (3.12). Digital technology-integrated entrepreneurship education presents remarkably higher differences (4.11) in competitive aggressiveness than traditional entrepreneurship teaching (3.58). Consequently, H1 is supported.

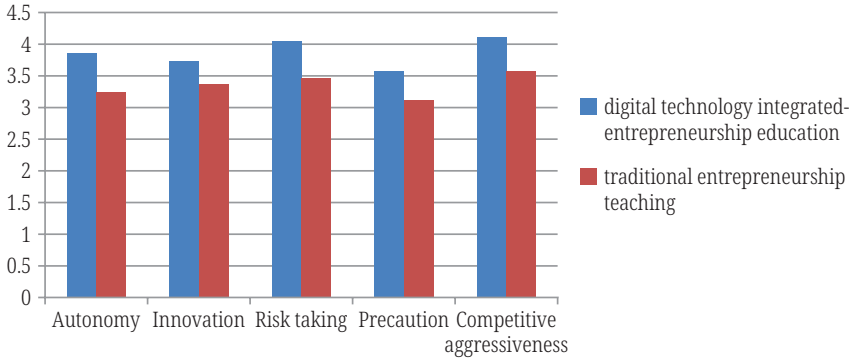

Fig. 1. Variance analysis of digital technology-integrated entrepreneurship education

Variance analysis of digital technology-integrated entrepreneurship education in entrepreneurial performance. According to an analysis of variance to discuss the difference between digital technology-integrated entrepreneurship education and entrepreneurial performance. Table 6 reveals significant differences between digital technology-integrated entrepreneurship education in economic performance and non-economic performance in entrepreneurial performance.

Table 6. Variance analysis of digital technology-integrated entrepreneurship education in entrepreneurial performance

Variable		F	P	Scheffe Post Hoc
digital technology integrated entrepreneurship education	economic performance	23.754	0.000**	digital technology-integrated entrepreneurship education > traditional entrepreneurship teaching
	non-economic performance	29.137	0.000**	digital technology-integrated entrepreneurship education > traditional entrepreneurship teaching

Note: **stands for $p < 0.01$.

Figure 2 reveals remarkable differences between digital technology-integrated entrepreneurship education and entrepreneurial performance. Digital technology-integrated entrepreneurship education appears to have significantly higher differences (3.89) in economic performance than traditional entrepreneurship teaching (3.32). Digital technology-integrated entrepreneurship education presents remarkably higher differences (4.25) in non-economic performance than traditional entrepreneurship teaching (3.67). As a result, H2 is supported.

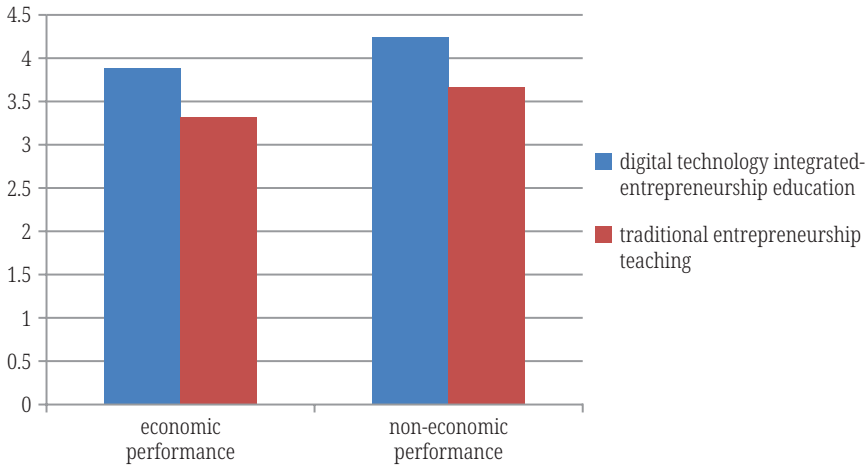

Fig. 2. Variance analysis of entrepreneurial performance

4.3 Effect analysis between entrepreneurship and entrepreneurial performance

Effect analysis between entrepreneurship and economic performance. To test H3, the analysis results, shown in Table 7, reveal notable effects of autonomy (β = 1.751*), innovation (β = 2.275**), risk taking (β = 2.133**), precaution (β = 1.862*), and competitive aggressiveness (β = 2.463**) on economic performance that H3 supports.

Effect analysis between entrepreneurship and non-economic performance. To test H4, the analysis results as illustrated in Table 7, show significant effects of autonomy (β = 1.942*), innovation (β = 2.069**), risk taking (β = 2.164**), precaution (β = 2.251**), and competitive aggressiveness (β = 2.354**) on non-economic performance. H4 is therefore supported.

Table 7. Analysis of entrepreneurship to entrepreneurial performance

Dependent Variable →	Entrepreneurial Performance			
independent variable ↓	economic performance		non-economic performance	
entrepreneurship	β	P	β	P
autonomy	1.751*	0.021	1.942*	0.005
innovation	2.275**	0.000	2.069**	0.000
risk taking	2.133**	0.000	2.164**	0.000
precaution	1.862*	0.014	2.251**	0.000
competitive aggressiveness	2.463**	0.000	2.354**	0.000
F	31.251		44.692	
significance	**0.000*** **		**0.000*** **	
R^2	0.337		0.396	
adjusted R^2	0.305		0.372	

Notes: *stands for p < 0.05; **for p < 0.01; ***for p < 0.001.

5 CONCLUSION

The survey results express the better effectiveness of digital technology-integrated entrepreneurship education on entrepreneurship and entrepreneurial performance than traditional entrepreneurship teaching. It reveals that different auxiliary tools and teaching styles could actually achieve distinct expected results and provide a reference for an alternative teaching model. A student with entrepreneurial skills represents an entrepreneur's autonomy, innovation, risk-taking, precaution, and competitive aggressiveness. Under such a premise, entrepreneurship should positively assist in entrepreneurial performance. Autonomy and precaution in entrepreneurship mainly reflect a student's mental state, i.e., whether a student is able to be independent, take risks, and actively respond to the environment, to more easily help the subjective entrepreneurial performance, i.e., enhancing the value of life and resulting in a different life through entrepreneurship.

The research results also reveal that current students prefer computer-related digital teaching styles. It is a worth-noting trend for teachers to pay more attention

to designing curricula and materials integrating various subjects with digital technology in order to attract students with learning effectiveness and achieve expected teaching objectives. Teachers who tend to practice digital technology-integrated entrepreneurship education in the future could consider the match with teaching sites, properly borrow multimedia audio-visual classrooms (e.g., classrooms equipped with electronic whiteboards and computer labs), or decorate the ordinary classroom to enhance the digital technology-integrated function for students' diverse stimulation and learning and achieve the preset teaching objectives.

Although digital technologies are applied to guide students to interpret various media and explore students' interpretation attitudes, a teacher guiding students' interpretation and learning with good interaction could have students totally involved in the interpretation rather than simply relying on digital technologies. A "live teacher" could appropriately guide students' interpretation direction, make reasonable answers to students' questions, and induce deeper problems for deeper thinking. It reveals the hidden meaning of digital technology integrated into entrepreneurship education to make judgments and interpretations and support individual interpretation attitudes. Apparently, it relies on a good digital technology-integrated entrepreneurship education guide to acquire the expected effectiveness of digital technology-integrated entrepreneurship education, in addition to the auxiliary tool of digital technology. They assume the role of a director in the entire teaching, while students are the characters cooperating with the directors.

6 SUGGESTION

Based on the above research results, the following suggestions are proposed in this study:

"Autonomy," "precaution," "competitive aggressiveness," and "risk-taking" in entrepreneurship positively affect students' entrepreneurial performance. In facing difficult tasks, they could overcome problems with high confidence, believe that they could complete irrespective of situation, and present the ability to observe the environment and risks. Students, in the future entrepreneurship model, could therefore get rid of the traditional thinking model, utilize the experiment and learn new knowledge, or participate in private or public courses to accumulate new knowledge in order to provide better service and added value for customers and continuously generate new entrepreneurship value through various learning styles. In such a competitive market, being responsible for solving problems could present unique characteristics.

Issues about entrepreneurship have been popular in recent years. It is believed that entrepreneurship-related courses are emphasized in schools. Schools opening more entrepreneurship management courses would largely help students understand the purpose of entrepreneurship, the entrepreneurship process, and even entrepreneurship behavior and value. High entrepreneurship is a good issue for a person with high entrepreneurial self-efficacy, either a fresh graduate or a student for continuous study, to further understand and present positive entrepreneurship as well as believe in entrepreneurship being able to influence entrepreneurial performance.

Schools should encourage teachers to engage in lesson plans for digital technology-integrated teaching, build a support channel for teachers practicing digital technology-integrated teaching, and provide sufficient and complete information-related equipment for teachers' convenient use of digital technology.

With insufficient multimedia classrooms, the digital technology environment in special classrooms should be promoted so that each teacher in teaching sites can receive teaching support. On the other hand, seminars and teaching observations of digital technology-integrated teaching could be conducted to enhance teachers' technology literacy and skills in integrating technology into teaching. Besides, teachers with distinct expertise could be encouraged to discuss and cooperate with each other. Under the integration of different fields, more suitable lesson plans might be created to insert multiple innovations and living springs for digital technology-integrated entrepreneurship education materials.

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8 AUTHORS

Hsin-Ming Hsieh is a PhD Student La Trobe University, Melbourne, Australia. Her research interests include entrepreneurship, innovation, and technology management (E-mail: H.Hsieh@latrobe.edu.au).

Alex Maritz is a Professor at La Trobe University, Melbourne, Australia. His research interest includes entrepreneurship, innovation, and technology management (E-mail: a.maritz@latrobe.edu.au).