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Effectiveness of Social Participation Courses Applied in the Disaster Prevention for Taiwanese K-12 Education

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Abstract: The development of disaster prevention literacy is not listed as a compulsory course in the K-12 education system in Taiwan, and there are very few academic departments that focus mainly on disaster prevention education in the domestic higher education system. For Taiwan, where disasters are relatively frequent, it is indispensable for every citizen to have the proper disaster prevention knowledge and response skills. In recent years, education courses related to disaster prevention have been gradually set up in general education courses in universities and colleges in response to the trend. This study took students of the elective courses on disaster prevention education in the general education courses of universities as the experimental subjects. Supplemented by the social participation course operation model, the cooperation of team members during the course can bring students a different experiential value to further achieve the teaching goal of improving learning achievement and feedback. It was found from the research results that: (1) the appropriate disaster prevention course arrangement can bring positive and significant effects on the dimensions of perceived experience and team interaction; (2) the learning mode of the university disaster prevention education course, combined with the social participation course operation model, was helpful to the improvement of experiential value and learning achievement; (3) the mediation regression analysis showed the cooperation mode of group team members' interaction did have a partial mediation effect in terms of experiential value, as well as learning achievement and feedback compared with the traditional pure classroom teaching model. The research results indicated that the teaching effectiveness of the disaster prevention education course for college students with the social participation course operation model was good.

Keywords: disaster prevention; partial mediation; social participation course



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1. Introduction

The occurrence of natural disasters around the world continues, and according to the statistic over the past twenty years from “Our World in Data” of the University of Oxford, around 1,230,000 people died from large-scale natural disasters equals to annually around 60,000 in average, which takes 0.1 percentage of the total number of death over the world. A total of 720,221 people (63%) died from earthquakes, 36,368 people (24%) died from extreme climate, 104,707 people (11%) died from flood, and 17,947 people (2%) died from landslide [1]. The book ‘How to Avoid a Climate Disaster: the Solutions we Have and the Breakthroughs we Need’ mentioned that 1–3% GDP expenditure will be used in disaster prevention [2]. According to the report of United Nations and OCED [3,4], 90% of earthquake deaths occurs in developing countries due to the underperformance in engineering design, construction practices, corruption of the building department, and the lack of knowledge and preparedness [5]. Natural disasters not only cause great destruction

to human lives, and especially in developing countries, but causes significant economic losses in developed countries [6]. Other than strengthening the documentation of the causes of events and improving disaster analysis capabilities, counting and reviewing from a historical perspective, learning about disasters, improving disaster risk awareness, and reducing disaster losses have become the key tasks of the government in every country. Since the 921 Earthquake in Taiwan in 1999, the relevant government departments have not only set 21 September as the National Disaster Prevention Day every year but also actively introduced disaster prevention education courses to all stages of the education system. Baytiyeh and Öcal [7] showed that incorporating earthquake risk education into school curricula is necessary to reduce the impact of future earthquake hazards and make vulnerable communities less vulnerable to future crises. However, in Taiwan's higher education system, few general education centers offer disaster prevention education courses.

In view of the fact that the government of Nigeria in West Africa has implemented a social participatory operation model to lead farmers to fight against climate change, the strategy has achieved great success [8]. In addition, there is no relevant literature in Taiwan that integrates the social participation operation model and disaster prevention education curriculum design into the teaching. Only recently the Taichung City Government's promotion of social participatory budget review has received enthusiastic responses from the general public [9]. This study was designed and implemented to fill the gaps in the literature. The purpose of this research is to use the disaster prevention education courses offered by the university general education center combined with the social participatory operation model to bring the courses to the service field for implementation. Students can make use of the disaster prevention knowledge or the skills learned to design a set of course learning models suitable for the service targets (e.g., the elderly in the community or the elementary school students) through the discussions and ideas of the team members and further to teach and interact with the service targets to deepen the students' self-disaster-prevention literacy in the process, to understand the students' overall learning achievement and feedback, and verify whether the perceived usefulness, team interaction, experiential value, and other factors have a mediation effect and also to explore the feasibility and related factors affecting learning achievement.

This study explored whether personal perceived usefulness is a subjective evaluation that can be controlled by improving experiential value or achievement and feedback in disaster prevention education courses. Therefore, we added team interaction, experiential value, and other influencing factors apart from the above-mentioned theories and research. Further, we proposed a comprehensive model combining the design of disaster prevention courses in the disaster prevention education of the university general education course with the social participation operation model. Moreover, we used perceived usefulness as a mediation variable to explore the model's impact on the experiential value and learning achievement and feedback.

2. Literature Review

2.1. Social Participation Courses

In the competitive environment of diversified learning and cross-field training, "service learning" and "social participation" will inevitably become key capabilities in the future lifelong learning process. The relationship between the two is also two sides of the same thing. Liu and Tsai [10] found that after the service learning, university students' communication ability, empathy, teamwork skills, social care and civic literacy will increase significantly. Therefore, if related learning and experience are provided to students in the general education course of universities, it will help university students become social persons, indirectly improving their adaptability to enter the workplace after graduation.

"Service learning" means that learners combine theories, learning goals, and self-reflection from the service activities in the social participation course field and apply the learned theories and course content to solve problems related to the served object or field. They can even learn how to integrate themselves as a member of the field and

become problem solvers through services and understand the true meaning of service. The experience of service learning is very meaningful to university students [11], especially their participation in the learning process [12]. Service learning is vital for higher education [13]. Zlotkowski [14] indicated that service learning is beneficial for university students to develop their problem-solving ability and build interpersonal relationships, something which also helps them quickly face the challenges of new environment and new education model. Service learning also helps students learn from experiences and at the same time increase their critical thinking ability to questions [15]. Students, schools, community agencies, teachers, and those who are served all benefit from service learning, which created a multi-win situation in education [16]. The two core elements of service learning are reflection and feedback. Service learning is a course-based, credit-bearing educational experience model that allows learners to achieve the goal of meeting the needs of the served through the arrangement and reflection process of the package course, promote the learning and development of the server, and nurture the correct sense of personal value and civic responsibility [17]. Eyley [18] pointed out that the reflection process of service learning should focus on whether problem-solving strategies, personal creativity growth, life-long learning skills, and analysis or insights on the causes of complex issues can be obtained via discussion. In addition, the reflection process should also focus on whether it can help individuals adjust to pressure and enhance group cohesion, where trust is also the focus of thinking [19]. According to the reports, students with service-learning experiences and active social interaction gain higher satisfaction in workplace [20–22]. Service learning not only improves interpersonal relationships but also significantly increases activities of daily living, learning motivation and job performance [23,24].

Instead of classroom teaching and learning, the main purpose of social participation courses [25] was planned by using the existed social issues and real field to help learners from different fields with their self-transformation through their feeling, experiences, hands-on and minds-on learning [26] in order to allow students to experience “service done”, “learning acquired”, and thinking about the learning concepts of how to “reflect the spirit of service”, “go out of the traditional classroom”, and “give back to the society” from the designed courses, then to achieve social participation. Social participation could be in ways of cultures, economy or other kinds of public lives, which improve participants’ public responsibility and service consciousness and as a consequence creates the value of mutual cooperation [27]. Through the operation of the disaster prevention courses via the social participation interface, students can identify with the service object or the field during the learning process, which inspires them in both microeconomics and macroeconomics to initiate re-learning to gain problem-solving abilities and recognize social responsibility [28–30]. The participating students can deeply feel the needs of the people being served and discover their potential value. This is the important purpose of offering courses in the field of disaster prevention in the general education of universities.

2.2. Disaster Prevention Literacy and Disaster Prevention Course Design

The so-called disaster prevention literacy can usually be divided into three aspects [31]: disaster prevention knowledge, disaster prevention attitude, and disaster prevention skills. The three are closely related, of which the course design for disaster prevention education is also constructed based on the abovementioned three aspects.

The subject content of disaster prevention courses roughly includes three categories: natural disasters, man-made disasters, and compound disasters. The quality of the course design and the final learning achievement and feedback must be related to a certain degree. The development of disaster prevention literacy has become an indispensable link among the education system of all countries in the world. Taiwan, which suffers from frequent natural disasters, is no exception. In recent years, the design of disaster prevention courses is no longer limited to the traditional one-way teaching method in the classroom [32,33]. Instead, various diversification models, interaction, and practical experience are continuously introduced to deepen learning achievement, cultivate disaster

prevention literacy, and teach students the correct concept of facing disasters and the attitude toward disaster prevention and mitigation. Consequently, they can use the disaster prevention literacy accumulated in peacetime, react quickly, and show enough resilience when disasters come.

Zhang et al. [34] had indicated that disaster prevention literacy of college students belongs to lower level. From the result of the survey participants, 79.43% of students show that their families are not prepared for the disasters. A total of 88.64% of them gain the disaster prevention knowledge from TV or the Internet while only 12.89% of them gain from school courses. Up to 77.8% of people indicate that they used to experience disaster education and 85.5% of people hope to attend systematic disaster prevention courses in which the rescue skills courses is much needed [35].

A large-scale investigation has been conducted by Dong et al. [36] concerning university students' disaster cognition and emergency response ability in Mainland China, Macao, Hong Kong, and Taiwan and the result showed university students' lack of unexpected disasters cognition, lack of emergency response ability and their deficiency of disaster related consciousness. Baytiyeh and Naja [37] showed that students from different subjects in Lebanese University shows that they have lower level of earthquake preparedness and higher-level academic institutions do not make a significant contribution to earthquake preparedness. A survey in way of questionnaire by Su et al. [38] about university students' focus on natural disasters, disaster prevention consciousness, knowledge of disaster theory, emergency response, and their thinking about education for disaster reduction showed that university students were at a low level in disaster cognition and there was a high bias between the disaster reduction education nowadays and students' expectation. It's suggested that disaster prevention related elective subjects be set up and combine with gym class and military training class to cultivate students' first aid, escape and survival skills, and related keynote lectures and drills are also necessary for students to enhance their evacuation, rescue and risk avoidance ability.

Academic institutions are regarded by students as the learning environment for their knowledge development, interpersonal relationship ability, and the foundation of safety culture in communities [39]. Consequently, there is an urgent need to set up disaster prevention courses in college and related research suggests that courses about the fundamental concept of risks and disasters are priority [40]. Otherwise, to improve college disaster prevention education system, the disaster prevention exercise should be conducted once a semester among all college departments as groundwork for reviews and disaster preparedness. As for the setting up of disaster prevention, Çalışkan and Üner [41] built the conceptual model base on mitigation, preparedness, response, and recovery dimensions and at the same time offered a basis for the development of the disaster literacy measuring tool and in the long run to make contribution to the evidence-based research.

In addition to the introduction to the field of action, environmental inspections, grouping of members, and interactive communication, the disaster prevention courses in this study also included climate change and various types of disasters in Taiwan, introduction to disaster prevention and rescue process and plans in Taiwan, the aging society and life disasters, community disaster prevention and community construction, teaching materials design for disaster prevention education promotion, introduction to life safety and disaster prevention, emergency medicine, discussion of common campus accident cases, design and implementation of disaster prevention teaching aids, action plan simulation and implementation, practical teaching in the field of service, and others. The on-site operation in the neighboring primary and secondary schools or communities was integrated into the process with the concept of learning from doing and doing while learning so that students in the course can become seed disaster-prevention teachers. It not only improves their own disaster prevention awareness but also enables them to assist service targets or the people around them in implementing disaster prevention and safety awareness. In this way, the students in the course can develop the correct values and sense of responsibility for disaster prevention education and get a deeper disaster prevention experience and literacy

cultivation to apply “disaster prevention as an attitude of life” in everyday life rather than merely taking it as a slogan.

2.3. Perceived Usefulness

Among the relevant theories on the acceptance of the use of information technology, the “technology acceptance model (TAM)” proposed by Davis et al. [42] and Davis [43] is the most extensively used, which can be applied to different research contexts, regardless of people, systems, and field and time backgrounds. It has become a research model that spans time, domains, and research subjects. This model introduces two personal beliefs of “perceived usefulness” and “perceived ease of use”, which are considered to directly affect the attitude toward use. Meanwhile, other influencing factors all have an indirect effect on the attitude through these two beliefs.

The theory of planned behavior (TPB) proposed by Ajzen [44] believes that people’s behaviors are not completely controlled by personal will but are also affected by perceived behavioral control. The so-called perceived behavioral control is the degree to which an individual feel that they can control or master a specific behavior. “Perceived usefulness” has direct influence on the acceptability of virtual learning environment, VLE; “perceived ease of use” and “Subjective Norm, SN” have indirect effect only on “perceived usefulness” while personal creativity and computer anxiety have direct effect on “perceived ease of use” [45]. Chai et al. [46] founded that “perceived usefulness” has positive correlation with attitude toward using. Lee et al. [47] indicated that “perceived usefulness” plays the mediator role between external variable and attitude toward using.

This study explored whether personal perceived usefulness is a subjective evaluation that can be controlled by improving experiential value or achievement and feedback in disaster prevention education courses. Wang [48] indicated that perceived practicality has positive correlation with experiential value. Therefore, we added team interaction, experiential value, and other influencing factors apart from the above-mentioned theories and research. Further, we proposed a comprehensive model combining the design of disaster prevention courses in the disaster prevention education of the university general education course with the social participation operation model. Moreover, we used perceived usefulness as a mediation variable to explore the model’s impact on the experiential value and learning achievement and feedback.

2.4. Team Interaction

While learning the courses, students can improve their learning process and improve academic achievement if they ask questions and participate in various class discussions [49]. Class participation is divided into three aspects, namely cognitive participation, emotional participation, and behavioral participation [50]. Cognitive participation [51] refers to the cognitive efforts for psychological contribution, learning, understanding, and acquiring knowledge. Emotional participation [52] includes emotional reactions, such as interest, boredom, self-confidence, and fear in the classroom, as well as attitudes towards schools, teachers, and learning. Behavior participation [53] refers to students’ general behavior (i.e., compliance with school rules and regulations) and all forms of behaviors that are more directly related to learning, including group questioning, filling in worksheets, and other forms of active learning activities. Talat and Riaz [54] analyzed how teams work from the view of information processing and found that information situation, communication information and task interdependence play important roles in teamwork [55]. Therefore, this study aims to enhance members’ communication, coordination and cooperation among each other through teamwork and team sharing [56]. Chang et al. [57] indicated that teamwork that applied in university students’ service experimental and learning camp abilities in the front, middle and back process helps accomplish the goal of the service experimental and learning camp through members’ interaction, candid communication and mutual trust and cooperation. The social participation operation model of this study was also based on the framework of team interaction, as well as small group division of labor and cooperation.

2.5. Experiential Value

Zeithaml [58] pointed out that the result and evaluation of the overall feeling of consumers' comparing the cost of the process and the feedback they receive after the experience is called value. The so-called experience is the practical wisdom accumulated by the interaction between the organism and the environment, which can be used to guide current life affairs [59]. Sheth et al. [60] showed that consumer decision process, consumers made decision according to product function, mass society connection, feelings, emotion situation, curiosity and the desire to knowledge, which is called "experiential value". In addition, experience is also known as people's evaluation of whether a certain thing is worth investing in or is similar to the original self-cognition through the degree of self-experience. Nowadays, there are multiple divisions of labor in society, and the meaning of "experience" is interpreted in each field from different professional perspectives. The theory of experiential marketing put forward has attracted the most attention. Schmitt [61] proposed the related elements of experiential marketing, including sense, feel, think, act, and relate. These five forms consist of the strategic experiential modules (SEMs), among which the concepts sense, feel and think are personal experiences, while act and relate are shared experiences. As a consequence, experiential value is a kind of mental spiritual satisfaction which forms deep memory or create good one [62]. Chen et al. [63] proposed that experiential value is visitor's overall feeling created from local team interaction when traveling.

Throsby [64] explored the components of experiential value at the cultural level and divided it into six aspects: aesthetic value, spiritual value, social value, historical value, symbolic value, and authenticity value. In the field of marketing, Mathwick et al. [65] divided the experiential value into four types based on the classification of consumer value: customer, return on investment, aesthetics, playfulness, and service excellence.

2.6. Achievement and Feedback

An effective feedback strategy for course teaching is an indispensable and important factor in achieving teaching goals. Related studies have shown that feedback is the information that learners receive through certain channels in learners' performance after learning [66], which is further divided into knowledge of performance (KP) and knowledge of results (KR). The former refers to the information on tricks, skills, or techniques about performance that learners receive from themselves, teachers, or coaches. On the other hand, the latter means that after learners complete the action response, teachers or coaches provide the relevant response results and skill performance characteristics and return the results to the learners [67].

The mutual feedback of peer learning is the most powerful information resource and the most effective feedback since, in the process of learning, the cultivation of interpersonal communication and social skills can be strengthened through mutual encouragement, mutual explanation, teaching, demonstration among the members of the same group, and cooperative learning environment. Feedback can stimulate the individual's internal learning motivation, making it easier to improve learning achievements and goals [68,69].

3. Methodology

3.1. Research Structure

This study took the subject courses related to disaster prevention education in the university general education program as the main research object to discuss the impact of disaster prevention course design, perceived usefulness, team interaction, the experiential value on achievement and feedback; and verify whether there is a mediation effect. The research structure model is shown in Figure 1.

Figure 1 found that the predictive variable (X) simultaneously affected the parallel mediation variables (perceived usefulness, M1; team interaction, M2). In turn, it affected the serial mediation variable (experiential value, M3), finally affecting the outcome variable (achievement and feedback, Y).

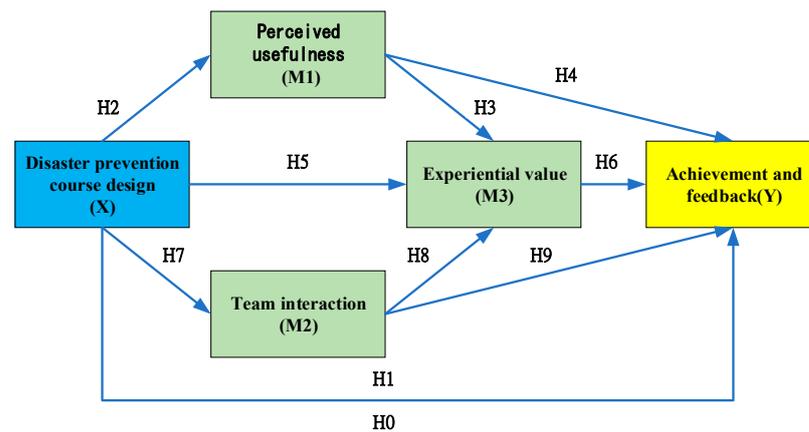


Figure 1. Research structure.

3.2. Research Hypotheses

In this study, relevant theories and research were summarized, and the path analysis concept of the multiple regression model was adopted to propose the following research hypotheses according to the research structure, as shown in Figure 1.

Hypothesis 0 (H0). “Disaster prevention course design” has a positive and significant overall effect on the “achievement and feedback” of general courses on disaster prevention education.

Hypothesis 1 (H1). “Disaster prevention course design” has a positive and significant direct effect on the “achievement and feedback” of general education courses on disaster prevention education.

Hypothesis 2 (H2). “Disaster prevention course design” has a positive and significant impact on the “perceived usefulness” of general courses on disaster prevention education.

Hypothesis 3 (H3). “Perceived usefulness” has a positive and significant impact on the “experiential value” of general courses on disaster prevention education.

Hypothesis 4 (H4). “Perceived usefulness” has a positive and significant impact on the “achievement and feedback” of general courses on disaster prevention education.

Hypothesis 5 (H5). “Disaster prevention course design” has a positive and significant impact on the “experiential value” of general courses on disaster prevention education.

Hypothesis 6 (H6). “Experiential value” has a positive and significant impact on the “achievement and feedback” of general courses on disaster prevention education.

Hypothesis 7 (H7). “Disaster prevention course design” has a positive and significant impact on the “team interaction” of general courses on disaster prevention education.

Hypothesis 8 (H8). “Team interaction” has a positive and significant impact on the “experiential value” of general courses of disaster prevention education.

Hypothesis 9 (H9). “Team interaction” has a positive and significant impact on the “achievement and feedback” of general courses on disaster prevention education.

3.3. Participates

By way of purposive sampling, this study was conducted for freshman to senior students who took elective courses in a one-semester in 2021 fall related to disaster prevention education in the general education program of a comprehensive university in central Taiwan (the geographic area where most people died from natural disasters in the recent

60 years according to the statistic [70]. A total of 132 people participated in the study by filling out the response scale questionnaire and there was a total of 124 valid samples (45 males and 79 females) after excluding the incomplete and invalid samples which meets the requirement of the existing literature [71]. There are two universities in this geographic area and the sampling distribution corresponded to the population which is considered to be representativeness of sample [72–74].

3.4. Research Tools and Measurement of Variables

The learning response scale and the questionnaire were adopted as the research tools. Five-factor dimensions (potential variables), namely (1) “disaster prevention course design”, (2) “perceived usefulness”, (3) “team interaction”, (4) “experiential value”, and (5) “achievement and feedback”, were planned in combination with disaster prevention education courses and the social participation operation model to complete the research items (observation variables). Each item in the scale was answered with a Likert five-point scoring method [75], with 5 point, 4 point, 3 point, 2 point, and 1 point, respectively, assigned for the five options, namely “Strongly agree”, “Agree”, “Somewhat agree”, “Disagree”, and “Strongly disagree”. According to the factor analysis extraction results, 4 to 6 items were retained as the measurement items for the five-factor dimensions, leaving a total of 23 items. There are five items for (1) “disaster prevention course design”: basic understanding, concept strengthening, thinking guidance, disaster prevention experience, and awareness enhancement; four items for (2) “perceived usefulness”: perceived diversity, perceived practicality, perceived help, and perceived benefit; five items for (3) “team interaction”: teamwork, team concept, team communication, team achievement, and team experience; six items for (4) “experiential value”: functional experiential value, interactive experiential value, inductive experiential value, knowledge experiential value, and feedback experiential value; three items for (5) “achievement and feedback”: effective feedback, experiential feedback, and application feedback.

3.5. Data Processing

In this study, after the students completed the questionnaire, the valid questionnaires (N = 124) were coded and logged, and the data were imported into the SPSS statistical analysis software to analyze the questionnaire data. This research operation follows the suggestion from Babbie et al. [76]. In addition to the basic descriptive statistics, multiple regression analysis methods in combination with the plug-in software PROCESS 3.5 Mode 80 and other statistical methods were also used [77]. Furthermore, the test significance level was set as $\alpha = 0.05$.

3.6. Statistical Methods

3.6.1. Exploratory Factor Analysis

This study aimed to understand the number and correlations of potential variables extracted from the observation variables originally measured (25 items) after exploratory factor analysis. Each student must go through a semester-long course work before qualified for taking the questionnaire survey. According to related literature of the factor analysis [78], when there are over 100 valid questionnaires and the number of the valid ones are five times than the question items, the statistical data has reference value [79–81]. There was a total of 25 items in the original observation variables of this study. After performing 3 rounds of factor analysis, items 16 and 22 were deleted in the 2nd and 3rd rounds, respectively, and a total of 5 dimensions (potential variables) were extracted from the remaining 23 items, which are “disaster prevention course design”, “perceived usefulness”, “team interaction”, “experiential value”, and “achievement and feedback”.

3.6.2. Validity Analysis

For validity analysis, this study used the principal component analysis method of factor analysis for factor extraction, performed a principal component analysis on the

original 25 items with the normalized Kaiser maximum variation method (Varimax) for the orthogonal rotation axis, and extracted the common factors through the component matrix after the rotation axis. For factors with a factor loading greater than 0.50 and the eigenvalues greater than 1.0, the communality between the items and component validity was further verified. The results [82,83] showed that the research factor explained less than 50% of the variation for all variables, indicating that the common method variation did not affect the results of this study.

3.6.3. Reliability Analysis

Generally, after the validity is confirmed by factor analysis, the reliability and validity of the questionnaire items will be further investigated. Thus, the reliability test must be carried out. The reliability test method commonly used in the Likert scale is the “Cronbach’s α ” coefficient or the “split-half reliability” [84]. Therefore, this study used the Cronbach’s α values (alpha reliability) of the overall scale and the scale of the five-factor dimensions to verify the internal consistency of the scales. Hair et al. [85] suggested that Cronbach’s α value should be greater than 0.7 to be viewed as credible; the questionnaire could be revised or the questions could be added or deleted if the α value is below 0.7.

3.6.4. Statistical Analysis Methods of Mediation Mechanism

In order to explore the mediation mechanisms of the disaster prevention course experience and achievement in the field of disaster prevention education and estimate the degree and importance of direct and indirect effects, this study used the Mode 80 in the PROCESS macro (version 3.5) [86]. This research follows Abu-Bader and Jones point of view that considers the significance of computation coefficient models [87], and also refers to Baron and Kenny’s point of view to verify the mediating effect [88].

All indirect effects were tested by bootstrapping analysis, using 5000 bootstrap samples to generate bias-corrected bootstrap confidence intervals. That is, the original data is replaced and repeatedly sampled thousands of times to estimate the pattern of each sub-sample, calculate its own indirect effects, and test the end value of the confidence interval of each sub-sample.

Figure 2 shows the use of Mode 80 in testing the hybrid serial-parallel mediation path method assumed in this study to estimate the parameters. The indirect effect was estimated by the percentile bootstrapping method using 5000 bootstrap samples. Considering the problem between the statistical power and Type I error in various inferential statistical methods, Hayes and Scharkow [89] believe that using the percentile bootstrapping method to test indirect effects is appropriate.

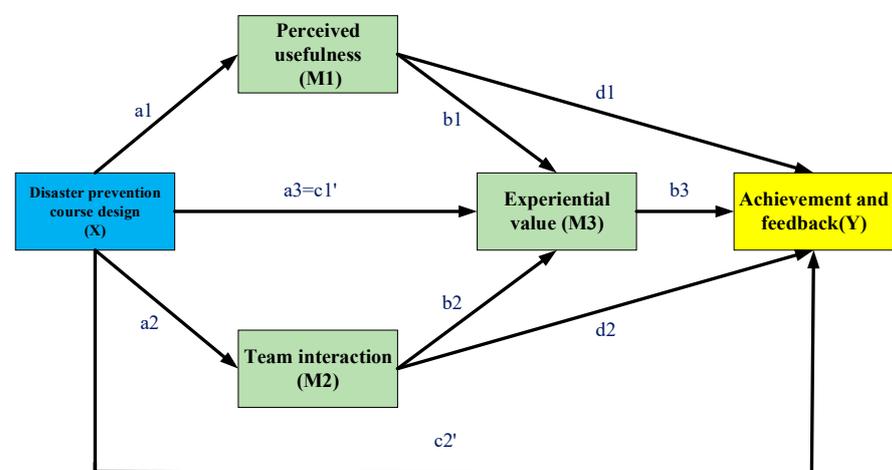


Figure 2. Estimation of path parameters of mediation effect model.

4. Results

4.1. Research Hypothesis Empirical Results

The research hypotheses formulated in this study based on the research structure are as follows. After the statistical analysis, 8 original hypotheses have positive and significant effects (H0, H1, H2, H5, H6, H7, H8, and H9), $** p < 0.01$. Only two hypotheses did not have significant positive effects (H3, H4). The complete research hypotheses and verification results are shown in Table 1.

Table 1. Research hypothesis empirical results.

Research Hypothesis	<i>p</i>	Empirical Results
H0: "Disaster prevention course design" has a positive and significant overall effect on the "achievement and feedback" of general courses on disaster prevention education.	0.000	Established
H1: "Disaster prevention course design" has a positive and significant direct effect on the "achievement and feedback" of general education courses on disaster prevention education.	0.006	Established
H2: "Disaster prevention course design" has a positive and significant impact on the "perceived usefulness" of general courses on disaster prevention education.	0.000	Established
H3: "Perceived usefulness" has a positive and significant impact on the "experiential value" of general courses on disaster prevention education.	0.080	Falsified
H4: "Perceived usefulness" has a positive and significant impact on the "achievement and feedback" of general courses on disaster prevention education.	0.274	Falsified
H5: "Disaster prevention course design" has a positive and significant impact on the "experiential value" of general courses on disaster prevention education.	0.000	Established
H6: "Experiential value" has a positive and significant impact on the "achievement and feedback" of general courses on disaster prevention education.	0.000	Established
H7: "Disaster prevention course design" has a positive and significant impact on the "team interaction" of general courses on disaster prevention education.	0.000	Established
H8: "Team interaction" has a positive and significant impact on the "experiential value" of general courses on disaster prevention education.	0.001	Established
H9: "Team interaction" has a positive and significant impact on the "achievement and feedback" of general courses on disaster prevention education.	0.002	Established

4.2. Correlation and Descriptive Statistical Analysis

To ensure the correlation between the various variables of the mediation mechanism of the constructed disaster prevention course experience and effectiveness, this study conducted a Pearson correlation analysis shown in Table 2 indicated a significant correlation among all variables, including predictive variable, parallel and serial mediation variables, and the outcome variable ($p < 0.01$), where X had a positive correlation with M1, M2, and M3.

Table 2. Correlation and descriptive statistics of variables.

Research Variable	M	SD	X	M1	M2	M3	Y
X- Disaster prevention course design	4.694	0.446	1				
M1- Perceived usefulness	4.659	0.448	0.835 **	1			
M2- Team interaction	4.524	0.645	0.551 **	0.566 **	1		
M3- Experiential value	4.624	0.491	0.799 **	0.740 **	0.602 **	1	
Y- Achievement and feedback	4.656	0.452	0.786 **	0.735 **	0.639 **	0.814 **	1

N = 124; ** $p < 0.01$.

4.3. Reliability and Validity Test

The varimax orthogonal axis was used to extract factors with factor loading greater than 0.5. In testing the scale's construction validity, the results showed that the KMO value of the scale of this study was 0.917, which is judged as a good value, after 3 rounds of factor analysis and the deletion of two items [90]. The χ^2 value of Bartlett's spherical test was 3342.663, $p < 0.001$, and reached a significant level [91], demonstrating that there were common factors among the items in the learning response scale. In addition, the average communality of the items was also 0.7 or more [92]. This finding means that the variance of each item can be explained by common factors to a good degree and is suitable for factor analysis. The result of the factor analysis showed that the cumulative total explained variance of the 5 common factors after the rotation axis was 82.998%, significantly more than 50%, indicating that the validity has reached a certain level. The scale used in this study has good factor validity. In addition, validation of validity was based on the method suggested by Anderson and Gerbing [93].

As mentioned above, Cronbach's α value was adopted as the reliability coefficient of the study to test the internal consistency of the scale. The Cronbach's α values of the five common factor scales extracted were between 0.897–0.953, and the Cronbach's α value of the overall scale was 0.973, implying good internal consistency of the scale. With regards to the reliability test, the study takes the standard suggested by Nunnally to set the Cronbach's α value of each variable to at least 0.7 [94]. The results are summarized in Table 3.

Table 3. Summary of item, validity, and reliability analysis.

Dimension Item	Observation Variable	Item Analysis		Validity Analysis			Reliability Analysis
		CITC	α Value after Deletion of This Item	EIGENVALUE	Cumulative Variance Explained %	Factor Loadings	Cronbach's α
Disaster prevention course design (A)	A1	Basic understanding	0.878	0.932	4.907	21.335	0.948
	A2	Concept enhancement	0.841	0.939			
	A3	Thought guidance	0.878	0.932			
	A4	Disaster prevention experience	0.848	0.938			
	A5	Awareness raising	0.843	0.938			
Perceived usefulness (B)	B1	Perceived diversity	0.707	0.845	4.169	39.459	0.872
	B2	Perceived practicality	0.695	0.848			
	B3	Perceived subservience	0.755	0.825			
	B4	Perceived effectiveness	0.757	0.826			
Team interaction (C)	C1	Team cooperation	0.889	0.961	4.130	57.417	0.966
	C2	Team concept	0.900	0.959			
	C3	Team communication	0.944	0.952			
	C4	Team achievement	0.900	0.959			
	C5	Team feels	0.888	0.961			
Experiential value (D)	D1	Experiential value of functionality	0.830	0.921	3.192	71.296	0.935
	D2	Experiential value of interactivity	0.752	0.929			
	D3	Experiential value of inducement	0.866	0.915			
	D4	Experiential value of emotionality	0.863	0.915			
	D5	Experiential value of knowledge	0.718	0.933			
	D6	Experiential value of feedback	0.826	0.920			
Achievement and feedback (E)	E1	Effective feedback	0.779	0.810	2.692	82.998	0.876
	E2	Experiential feedback	0.760	0.828			
	E3	Application feedback	0.748	0.839			
Total scale							0.966

5. Discussion

This study explored that the teaching effectiveness of the disaster prevention education course for college students with the social participation course operation model. The control value theory of achievement emotions refers to learning achievement-related emotions for examining the affective factors [95–97].

5.1. Parameter Estimation of Mediation Effect Model

This study used disaster prevention course design (X) as the independent variable, achievement and feedback (Y) as the outcome variable; and perceived usefulness (M1), team interaction (M2) and experiential value (M3) as mediation variables, as shown in Table 4. First, the disaster prevention course design (X) had a significant positive predictive effect on perceived usefulness (M1), and its prediction explained the variance of 69.7%. The prevention disaster course design (X) had a significant positive predictive effect on team interaction (M2), and its prediction explained the variance of 30.4%. Second, both disaster prevention course design (X) and team interaction (M2) had a significant positive predictive effect on the experiential value (M3), and its prediction explained the variance of 68.4%. Finally, disaster prevention course design (X), team interaction (M2), and experiential value (M3) also had a significant positive predictive effect on achievement and feedback (Y), and the prediction explained 74.1% of the variance.

Table 4. Regression coefficient and model summary for mediated regression analysis of curriculum learning effectiveness.

Result Variable	M1			M2			M3			Y						
	Predictive Variable	Coefficient	t	p	Coefficient	t	p	Coefficient	t	p	Coefficient	t	p			
Constant term	i_{M1}	0.485	1.659	0.099	i_{M2}	0.746	2.565	0.011	i_{M3}	0.281	1.046	0.297	i_Y	0.075	0.354	0.724
X	a_1	0.848	12.300	0.000	a_2	0.818	11.915	0.000	a_3	0.270	2.713	0.008	c_2'	0.295	3.656	0.000
M3													b_3	0.185	2.723	0.007
M1									b_1	0.274	3.403	0.001	d_1	0.241	3.630	0.000
M2									b_2	0.379	4.690	0.000	d_2	0.264	3.835	0.000
Model summary		$R^2 = 0.523$ F(1,138) = 151.296		$p < 0.001$		$R^2 = 0.507$ F(1,138) = 141.969		$p < 0.001$		$R^2 = 0.621$ F(1,138) = 74.247		$p < 0.001$		$R^2 = 0.745$ F(4,135) = 98.484		$p < 0.001$

Note: Course content arrangement (X), Interactive teaching experience (M1), Technology action puzzle (M2), Learning effectiveness (M3), Achievement and feedback (Y).

5.2. Test of Effects of Mediation Mechanism

This study tests the overall, direct, and indirect effects, as shown in Table 5. First, the disaster prevention course design (X) had a significant positive overall effect on the achievement and feedback (Y) ($c_2 = 0.796$, $t = 14.031$). This is followed by disaster prevention course design (X), which also had a significant direct effect on achievement and feedback (Y) ($c_2' = 0.276$, $t = 2.801$) after adding the mediation variables, such as perceived usefulness (M1), team interaction (M2), experiential value (M3), etc. Disaster prevention course design (X) still had a significant positive impact on achievement and feedback (Y), showing that this mode was partial mediation, where the strength of mediation was as high as 65.3%.

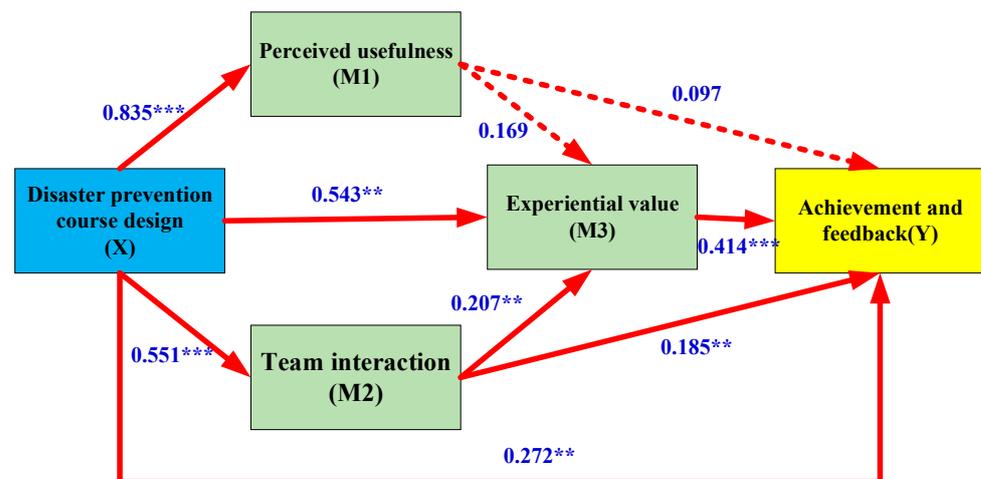
Finally, the disaster prevention course design (X) through perceived usefulness (M1), team interaction (M2), experiential value (M3), and other mediation variables had a significant positive-sum indirect effect on achievement and feedback (Y) (total indirect effects). The tests of each path's specific indirect effects respectively showed that (1) disaster prevention course design (X) failed to have significant indirect effect on achievement and feedback (Y) through the mediation of perceived usefulness (M1); (2) disaster prevention course design (X) had a significant indirect effect on achievement and feedback (Y) through the mediation of team interaction (M2) and the strength of the mediation effect reached 13.0%; (3) disaster prevention course design (X) did not have a significant indirect effect on achievement and feedback (Y) through the mediation of perceived usefulness (M1) and experiential value (M3); (4) disaster prevention course design (X) had a significant indirect effect on achievement and feedback (Y) through the mediation of team interaction (M2) and experiential value (M3), but the strength of the mediation effect was only 6.6%.

Table 5. The overall, direct, and indirect effects of mediated regression analysis on the learning effectiveness of courses.

Category (Coefficient)	Effect Path	Effect Size	<i>t</i>	<i>p</i>	Bootstrapping 95% Trust Interval	
					Lower Limit (LLCI)	Upper Limit (ULCI)
Overall effect (c2)	X→Y	0.796	14.031	0.000	0.684	0.909
Direct effect(c2')	X→Y	0.276	2.801	0.006	0.081	0.471
Aggregate indirect effect	X→Y	0.520			0.242	0.782
Indirect Effect(a1 × d1)	X→M1→Y	0.822			−0.073	0.276
Indirect Effect(a2 × d2)	X→M2→Y	0.103			0.001	0.223
Indirect Effect(a3 × b3)	X→M3→Y	0.228			0.082	0.393
Indirect Effect(a1 × b1 × b3)	X→M1→M3→Y	0.059			−0.020	0.186
Indirect Effect(a2 × b2 × b3)	X→M2→M3→Y	0.048			0.004	0.114

Note: Disaster prevention course design (X), perceived usefulness (M1), team interaction (M2), experiential value (M3), achievement and feedback(Y).

The standardized regression coefficients of each path in Figure 3 showed that the mediation mechanism of the disaster prevention course experience and effectiveness constructed by this study had three significant indirect effects. The mediation mechanism involved two strong paths, namely disaster prevention course design (X)→experiential value (M3)→achievement and feedback (Y), and disaster prevention course design (X)→team interaction (M2)→achievement and feedback (Y). The weaker path was disaster prevention course design (X)→team interaction (M2)→experiential value (M3)→achievement and feedback (Y).

**Figure 3.** Mediation effect model analysis results (** $p < 0.01$, *** $p < 0.001$).

The above-mentioned statistical results indicate that “team interaction” and “experiential value” are key factors to “achievement and feedback”. The “team interaction” dimension is planned and designed according to the concept of cognitive participation, emotional participation and behavioral participation while in this study is divided into five questionnaires including team cooperation, team concept, team communication, and team achievement to match the study’s situation of disaster prevention for college students. Both results show that “team interaction” used in disaster prevention courses enhance college students’ learning effectiveness. The “experiential value” is planned according to the theoretical framework of experiential marketing and is conducted into the following six questionnaires of experiential value of functionality, experiential value of interactivity, experiential value of inducement, experiential value of emotionality, experiential value of knowledge, and experiential value of feedback in which the significant indirect effects are shown.

The statistical data analysis of this study is as follows. (1) Most of the original research hypotheses established are in conformity with other researchers [98–103]. Only two hypotheses were not established: (H3) “perceived usefulness has a positive and significant impact on the experiential value of general courses of disaster prevention education” and (H4) “perceived usefulness has a positive and significant impact on the achievement and feedback of general courses of disaster prevention education”. (2) The learning response scale has reached a certain level. (3) In terms of verifying the mediation effect, team interaction and experiential value did have a partial mediation effect on the impact of disaster prevention course design on learning achievement and feedback in conformity with other researchers [100,101].

The summary of this study is as follows. (1) General education courses related to disaster prevention, when offered in universities, will not be able to improve experiential value, bring positive effects on the learning achievement and feedback of the disaster prevention education courses, or achieve learning goals if the students taking the courses stop at the cognitive level of “perceived usefulness”. For example, students would (a) only understand that disaster prevention education courses are rich and diversified in content; (b) only understand that the knowledge on disaster prevention and mitigation as well as disaster relief is useful in life; (c) only know that having good disaster prevention skills is helpful for their own safety; and (d) only agree that the overall benefit of learning disaster prevention courses is high, or the motivation for some students to take such courses is only to meet the requirements of the school’s general education credits. (2) If a good disaster prevention education course can be designed to provide students with complete learning, experience, and practice, the results would show that students’ response is good for the achievement and feedback in having basic knowledge of disaster prevention and disaster relief or other content. (3) Introducing the social participation course operation model into the university disaster prevention education courses through group team interaction with actual field service learning can not only improve students’ learning achievement, make them think about how to meet the needs of service receivers, and stimulate their own potential, but it can also strengthen their ability to respond to various types of disasters in the future, further affecting their family or friends. (4) Students who have taken the courses are also willing to conduct further study or research on knowledge related to disaster prevention education if relevant opportunities are available in the future to achieve a positive cycle in promoting disaster prevention education. (5) The launch of disaster prevention education is indeed an urgent need for college students. The disaster prevention education courses in this study aims to let students understand about different types of natural disasters and risks in Taiwan, and to think and experience the disasters in their daily lives in order to carry out the further teaching goals of learning from doing and doing while learning, and at the same time to enhance students’ disaster prevention literacy, which is same as what scholars suggested in reference [14] to design the courses based on risks and disasters as priority.

6. Limitations and Future Recommendations

This study strives for preciseness but still has the following limitations which can be offered as suggestion for further related researches in the future. First, as far as the research participants are concerned, this study only chose university students as samples. Therefore it is suggested that further studies consider students in different study periods (senior high school, junior high school, elementary school and kindergarten) in order to understand the differences. Secondly, in response to the COVID-19 pandemic and to follow government’s epidemic prevention regulations, this study was not able to have any further counseling interviews with university students. We suggest future researchers toward related topic to consider qualitative research [104–106], narrative research [107,108], grounded theory [109,110], case study [111], and quantitative research [112] to increase research’s reliability and validity. In terms of statistical analysis, since the validation only is limited to university students in this research, we suggest collecting observations from different

participants toward the same condition in the future, and at the same time make use of the multilevel model [113] or hierarchical linear model, HLM [114] for analysis in order to delineate the interaction effect of cross-level analysis and to complete the research results.

7. Conclusions

This study took elective disaster prevention education courses in the general education program of universities. The content mainly focused on the social participation course operation model and the discussion of related courses on disaster prevention education. To design the operating modes for the courses for audiences of different ages and on different topics, such as students of other academic systems or social people, we should consider the essential differences. That is, when thinking about the scenario and planning for other similar research topics, we still need to focus on the “perceived usefulness”, “team interaction”, “experiential value”, and other dimensions or items for further exploration or introduce different learning modes to verify learning achievement and overall feedback further. Further research direction will be: (1) to choose different kinds of audience as research object or use related disaster prevention courses as situation study direction; and (2) to increase the participant quantity of attending the disaster prevention related courses.

Government in countries around the world should be prepared for the natural disasters that will happen at any time, and therefore the strengthening in disaster prevention and reduction become the common issue that the government and public should face together in which the education is the primary part that should be started first. It is expected that the similar operation model which combines disaster prevention education and social participation implemented in this study will be widely accepted and applied.

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