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Original Paper

The Effect of Distance Teaching on Academic Achievement in the Online Course of Introduction to Computers Science

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Abstract

For distance teaching, if the teacher can obtain the predicted scores that students may obtain in the final exam at this time, the students whose predicted scores do not meet the standard can be found. Teachers can strengthen the teaching of this type of students in the teaching process, which will greatly improve the overall teaching efficiency of teachers. The target of this research is the students of the course of the "Introduction to Computers Science" at Open University of Kaohsiung. This course is a distance teaching based on online teaching, and the questionnaire and final test are also completed on line. A total of 95 students filled out the questionnaire online, accounting for 77.24% of the electives. This study aims to assess the measurement of students' pre-learning computer experience, software operation ability, learning motivation, and computer attitude, and analyze their relationship with the performance of subsequent distance teaching on the course of the "Introduction to Computers Science", and find a multiple regression model to predict student performance. It was found that a multiple linear regression model combining 7 independent variables was statistically significantly related to the final test scores.

Keywords

pre-learning computer experience, learning motivation, online teaching, computer attitude, distance teaching, introduction to computers science

1. Introduction

The Open University of Kaohsiung (OUK) is an adult education university that provides lifelong learning. It provides a dreaming opportunity for people who drop out of school early and fail to receive higher education, so that people who want to obtain a university diploma do not need to pass any exams, and there are no admission qualification restrictions. As long as the people of Taiwan who are over 18 years old can register for school, the school play a very important role in solving the

knowledge gap of the relatively vulnerable people in Taiwan. With the advancement of the times, and Taiwan's gradual entry into an advanced society, lifelong learning is a must for everyone today. The idea of living to old age and learning has prompted many people to study new knowledge instead of obtaining a university diploma. Many seniors who have retired in the workplace have chosen course at OUK. The OUK has made great contributions to improving people's life knowledge and providing opportunities and places for lifelong learning for Taiwanese people.

Students who take the course of the "Introduction to Computers Science" at OUK have different computer experience, motivation and basic background (age, education, social experience), and the course is online teaching, plus students are free to elective without age, education and grade restrictions, students' computer knowledge background is very scattered (Kuo, 2020).

In this course, the content of distance teaching is designed by teachers according to their own profession, and teachers have insufficient knowledge of students' knowledge background and learning motivation. However, a good teaching will not be perfect if it cannot match the students' starting behavior and learning motivation. It will have an impact on students' learning effectiveness. Generally speaking, at the beginning of distance learning, teachers are almost completely unfamiliar with students. If the teacher can obtain the predicted scores that students may obtain in the final exam at this time, the students whose predicted scores do not meet the standard can be found. Teachers can strengthen the teaching of this type of students in the teaching process, which will greatly improve the overall teaching efficiency of teachers.

This is a 3-credit course per semester and is conducted through distance learning. Teachers use multimedia systems to apply Information and Communication Technology (ICT) applications to provide course content in the form of digital audiovisual materials. The teaching content of 54 lectures was produced and placed on a digital teaching platform for students to learn online. In addition, there are online discussion areas and four back-to-school teaching activities. The online discussion area allows students to discuss teaching content and teachers can also participate. The four back-to-school face-to-face teaching activities (once a month, 100 minutes each time) are mainly used to supplement and guide the teaching content of distance learning. Finally, an online final quiz will be conducted.

This research mainly explores the understanding of the computer experience, computer attitude and learning motivation of students in the "Introduction to Computers Science" course based on distance teaching. Combined with the final test scores, the paper discusses the relationship between the student's computer experience before learning and the relationship between learning motivation and test scores. The research results are handed over to the curriculum planning decision-makers as a reference for planning advanced course, and hope to find a set of multivariate variables that are significantly related to the test scores, establish a prediction model, and help teachers predict the students' learning achievements, as early as possible to strengthen the teaching of students with possible low grades.

Kim and Peterson (1992) believe that the computer introduction course plays a vital role in introducing basic computer concepts and skills to college students. The improvement of students' computer abilities is based on the introduction of computers. They have solid computer basic knowledge, and they are competent for the use and discussion of computer-related equipment in the future. Ideally, students who complete such course should have sufficient computer literacy and the ability to acquire more complex computer skills in subsequent course or workplaces (Kim & Keith, 1994). To ensure that all students have a similar understanding of basic computer skills and concepts, introductory course usually assume that students have little relevant computer experience (Brock, Thomsen, & Kohl, 1999). Therefore, the introduction to computers can construct students' basic knowledge of computers.

The students at OUK are all social people, and most of them have smartphones. Thus, they could browse, search for information, chat, leave messages, take photos, go to websites, and use mobile payment applications. They might even have used all the functions of ICT in smartphones. However, they may not understand the basic operations of traditional computers and the knowledge related to application software and computers (Kuo, 2020). Due to the diversified sources of the students in this course, teachers' knowledge of students' knowledge background, computer experience before class, computer attitude and learning motivation are quite weak. Therefore, it is necessary to study the background, computer attitude and motivation of students in the course of the "Introduction to Computers Science" based on distance teaching.

2. Literature Review

2.1 Computer Experience before Learning

Smith, Caputi, Crittenden, Jayasuriya, and Rawstorne (1999) divided the previous computer experience into subjective and objective categories. Subjective refers to the feeling of like or dislike of the computer, that is, computer anxiety and computer attitude. Objective previous experience refers to externally observable variables that interact with computers including computer usage, usage opportunities, and usage diversity. Varma and Marler (2013) believe that previous computer experience has two dimensions: computer proficiency and computer frequency. Brock et al. (1999) found that almost any type of computer experience, especially video game experience, has improved the computer literacy level of freshmen to a certain extent. But, surprisingly, it was found that exposure to computer information systems at the high school or community college level had almost no significant impact on students' computer literacy (Rex & Roth, 1998). Before students participate in the course, first evaluate the measurement of computer experience and computer self-efficacy, and analyze its relationship with the performance of subsequent course. Explore the relationship between the total years of computer experience, the current average computer hours per week, and the number of computer course completed before and the performance of subsequent course. It is found that none of these three measures can be directly used as an important predictor of subsequent course performance. They recommended to further understand the relationship between previous computer experience and

computer literacy and performance.

This study will use the frequency of computer use, the number of computer course ever studied, the most familiar computer skills and other factors to explore the relationship between the students' pre-learning computer experience and the learning performance of the course of the "Introduction to Computers Science" based on distance teaching.

2.2 Learning Motivation

According to human development professionals, there are two types of learning motivation, namely extrinsic motivation and intrinsic motivation. External motivation refers to the use of external things to induce students to engage in learning activities; internal motivation refers to the motivation caused by people's interest in learning itself. When a person likes to engage in a certain learning activity because he feels that this learning activity has "Interest", "Like", "Happy", "Need", "Target", and no other external reasons, this potential internal force is "intrinsic motivation". Lepper (1988) pointed out that external motivation refers to obtaining some kind of reward or avoiding some kind of punishment external to the activity itself, such as reward or teacher's approval; internal motivation is for its own sake, and regards internal motivation as what it is the enjoyment provided, the learning allowed or the sense of accomplishment inspired.

Afzal, Ali, Khan, and Hamid (2010) believe that students with intrinsic motivation prefer to use strategies that require more effort and make them process information more extremely, while students with external motivation tend to pay the least effort to obtain the maximum return. Stipek, Feiler, Daniels, and Milburn (1995) believe that learning motivation is a student's motivation for achievement in learning, a psychological need for individual pursuit of success, and one of the main factors affecting academic achievement. The study found that learning motivation has a strong relationship with students' academic performance, and it is concluded that students with intrinsic motivation are academically better than students with extrinsic motivation (Afzal et al., 2010).

The students of this course are all adults. Adult motivation is reflected in setting goals, maintaining attention in certain activities, and exerting effort and perseverance to achieve goals. According to the conclusion drawn by the Institute of Educational Psychology, it is pointed out that in the learning of adults, high positive motivation can play a compensatory role, especially when a person's ability is low or knowledge reserves are insufficient (Lukianova, 2016). And what is the inner learning motivation of adults? According to M. Bryn and S. Mann, the inner motivation of adult learners is caused by the constant desire to learn, which can be characterized as an attitude: "I really want to do" Instead of "because I want to do it, so I do", or "I need" (Lukianova, 2016).

Therefore, before teaching this course of the "Introduction to Computers Science" based on distance teaching, it is necessary for adult students from all directions to thoroughly understand their learning motivations, determine their needs, interests and tendencies, because these usually have a significant impact on learning outcomes.

2.3 Learning Attitude and Performance

Students' learning attitudes have a considerable impact on academic performance, and most educational scholars and teachers agree that a positive learning attitude can improve students' academic performance. Kiekkas et al. (2015) assessed the impact of biostatistics course on the statistical attitudes of nursing students, and explored the relationship between these attitudes and their performance in course examinations. The study found that the correlation between the overall scale score and examination performance was positive and significant, but weak; and previous research on medical students has reported that the relationship between the two is moderately related (Beurze, Donders, Zielhuis, de Vegt, & Verbeek, 2013; Zhang et al., 2012). However, Bidegain and Mujika (2020) explore the relationship between scientific attitudes and PISA (The Program for International Student Assessment) scientific performance. From a broader perspective (e.g., across countries and regions), the relationship between all attitude variables and science achievement using aggregated PISA scores was found to be negative. Hignite and Echternacht (1992) believed that computer attitude cannot be used to predict the existence of corresponding levels of computer literacy. But, Klein, Knupfer and Crooks (1993) evaluated the students' attitudes towards computer learning, and checked the students' computer knowledge and computer skills performance after attending the course, and found that students with positive learning attitudes had significantly better performance assessments. Shen, Wu and Lee (2014) proposed a case study to discuss the impact of their proposed system on college students' attitudes towards computer science, and found that students' attitudes towards computer science improved, and previous studies have shown that positive attitudes toward course tend to produce better results on achievement measures. Gopu (2016) focused on to explore the introduction of student's attitude towards computer science. It was found that there was a strong correlation between students' academic performance and their personal perceptions of competence during the course (Gomes, Santos, & Mendes, 2012); and there was a significant positive correlation between students' attitudes and their achievements in programming (Baer, 2013).

Most of the above studies on the relationship between learning attitudes and achievements are aimed at general students, and there is relatively little research on the relationship between computer learning attitudes and academic performance of adults who participate in distance teaching like OUK, so they are also included in this study.

3. Methodology

The main purpose of this research is to evaluate the measurement of students' computer experience, software operation ability, learning motivation, and computer attitude before taking the course of the "Introduction to Computers Science" based on distance teaching, and analyze its relationship with subsequent course performance. Find a multiple regression model to predict student achievement in computer literacy course. The content of the course is that teachers use general computer content to conduct online teaching (Kuo, 2020). Based on the content of the lecture, 100 questions are given, 1

point for each question, and a final online test is taken, which is regarded as the score obtained by the students after taking the course. This research offers the following contributions to the literature:

1) Understand the relationship between demographic variables and final test scores.

2) Analyze the relationship between students' pre-learning computer experience, clerical software operation ability, learning motivation and computer attitudes and the final test.

3) Identify a set of multivariate variables that have a significant relationship with the final test scores to build a predictive model.

To verify the research questions, the following null hypothesis are assessed:

1) There are no statistically significant differences at the level of (0.05) between final test scores and demographic variables.

2) There are no statistically significant correlations at the level of (0.05) between final test scores and pre-learning computer experience.

3) There are no statistically significant correlations at the level of (0.05) between final test scores and learning motivation.

4) There are no statistically significant correlations at the level of (0.05) between final test scores and computer use experience.

5) There are no statistically significant correlations at the level of (0.05) between final test scores and computer attitudes.

6) There are no statistically significant correlations at the level of (0.05) between final test scores and clerical software operation ability.

3.1 Design of Research Experiment and Evaluation Questionnaires

This research questionnaire mainly includes four groups: demographic variables, computer learning experience, computer use experience, personal feelings and opinions, and includes a computer attitude scale and a clerical software operation ability scale. Demographic variables include five items including gender, age, education, OUK time already enrolled, and whether you have a personal computer. There are two questions for computer learning experience and personal feelings and opinions, and three questions for computer use experience.

In addition to the two scales, there are 12 items in the questionnaire. The content of the questionnaire was modified from Lin (2007). The instrument of clerical software operation ability scale is the author's own proposition based on teaching experience. The above content is slightly modified by expert opinions. The computer attitude scale uses the scale used by Kuo (2020). The contents of the 12-items questionnaire are shown in Table 1. The clerical software operation capability scale is shown in Table 2.

These two scales were measured by a Likert scale from 1 strongly disagree to 5 strongly agree. After analysis, the Cronbach α of the computer attitude scale for this study was.949, the clerical software operation ability scale was .937. The Cronbach α of these two scales is >.9 in this study, which is an excellent reliability level according to the rules of George and Mallery (2003).

3.2 Participant and Data Analysis

This research is aimed at students who take the course of the "Introduction to Computers Science" based on distance teaching. Students are notified and voluntarily encouraged to fill out the questionnaire online before the course begins. It takes approximately 15 minutes to complete the questionnaire. After the course is completed, take the final exam online. The total number of students taking this course is 123, and there are 110 students who took the final exam at the end. 95 of the students who took the final exam filled out the questionnaire. These 95 participants are the sample of this study. The sample size is about 77.2% of the original electives and about 86.4% of the students taking the final exam. The average score of 110 students who participated in the final exam was 83.9 points, while the average score of 95 sample students who participated in the questionnaire was 83.76 points, which is quite close.

The computer statistics software SPSS for Windows (version 20.0) is used for the data analysis, and reliability analysis, Person correlation test, regression analysis, and analysis of variance are applied to test various hypotheses.

Table 1. Questionnaire Content

Category	Item
Demographic variables	Gender
	Age
	Education
	OUK time already enrolled
Computer learning experience	Do you have a dedicated computer?
	Have you ever taken any computer-related course?
	What is your main motivation for learning computers?
Computer use experience	How long have you been using a computer?
	On average, how long do you spend on computer-related equipment (including smartphones) every day?
	What is your purpose of using computer-related equipment most often?
Personal feelings and opinions	What computer skills are you most familiar with?
	Do you think the technical skills you possess are sufficient?

Table 2. Clerical Software Operation Ability Scale

Questions
1. I can use clerical software to modify the font, size and color of the text in the document.
2. I can use the page border of the clerical software as the cover of the report.
3. I can use the Drop Caps function.
4. I can insert a page number for the document.
5. I can use Bullets and Numbers to input data.
6. When aligning the data between line and line, I can use the TAB key at keyboard.
7. I can set the positions of tabs in a paragraph.
8. I can use preview printing before printing the document.
9. I can use the function of Align Center.
10. I can use the indent function to set the paragraph format.

4. Discussion

4.1 Demographic Analysis

4.1.1 Gender

Males have higher academic performance than Females, as shown in Table 3. Further analysis of the ANOVA test results in F=.469, P=.495, and the null hypothesis 1 cannot be rejected. It indicates that there is no obvious gender difference in the final grades of the students.

Table 3. Gender and Final Test Scores

Gender	Number	Percentage	Average Score	Standard Deviation
Male	47	49.47%	84.9	13.64
Female	48	50.53%	82.6	18.53

4.1.2 Age

Because there is no age limit for the selection of course for the OUK students. The age distribution of students who choose to take this course is very wide as shown in Table 4. It is found from Table 4 that the average scores of the 36-45, 46-55, and >56 age groups are 86.1, 93, and 87.7 points respectively, which are higher than the average score of the whole class, while the youngest 18-25 age group has the lowest average score of 79.1. As a result, it is clear that older students are not inferior to young students in the study of the course toward the “Introduction to Computers Science”. This is different from the current belief that young people’s acceptance of computer literacy is higher than that of older people. This also shows that older students are more serious in their studies than younger students. After the ANOVA test results in F=6.661, P=.012, because the P value was <0.05, null hypothesis 1 can be rejected. It shows that there is obvious age difference in the students’ final grades.

Table 4. Age and Final Test Scores

Age	Number	Percentage	Average Score	Standard Deviation
18-25	25	26.32%	79.1	18.9
26-35	33	34.74%	82.0	17.4
36-45	22	23.16%	86.1	12.3
46-55	12	12.63%	93.0	7.6
>56	3	3.16%	87.7	20.5

4.1.3 Education

Since the OUK has no restrictions on students' qualifications for taking this course, the qualifications of students taking this course are also scattered. Table 5 shows the distribution of educational level and final test scores of students who choose course. The results show that the average final grades of secondary school and high school students are 96.3 and 84.8, respectively, which are higher than the average of the whole class. While the scores of college and university students are 79.6 and 78.8, respectively, which are lower than the average of the whole class. And found that academic qualifications and final test scores are inversely proportional, which shows that students with lower academic qualifications are more serious. Because OUK adopts registration for admission, as long as citizens who are 18 years old or older can enroll, provide an opportunity for early dropouts to receive higher education, and play the role of lifelong learning, fostering knowledge disadvantaged groups and people enrich knowledge. This one as a result, OUK did achieve this goal. After the ANOVA test results in F=3.538, P=.063, and null hypothesis 1 cannot be rejected. Although the P value is greater than 0.05, it is close to 0.05, so it is still one of the important factors affecting the test score.

Table 5. Education and Final Test Scores

Education	Number	Percentage	Average Score	Standard Deviation
Secondary school	4	4.21%	96.3	3
High school	64	67.37%	84.8	14.7
College	21	22.11%	79.6	21.7
University	6	6.32%	78.8	10.9

4.1.4 OUK Time Already Enrolled

OUK has no restrictions on school years. Students choose subject arbitrarily by themselves and record their learning status by accumulating credits. There is no grade system like general school, so we use the OUK time already enrolled as the equivalent of general school grades. Discuss the relevance of OUK time already enrolled and final test scores. It can be seen from Table 6 that the average scores of the two groups of students studying at OUK for one year and three years are 87.8 and 84.7, respectively,

which is higher than the class average. It indicates that the students of these two groups are most used to and familiar with the school's on-line teaching model and learning method. It can also indicate that students in these two groups are studying more seriously. The average score of freshmen is 78 which is the lowest and much lower than the average of the whole class. It may be caused by freshmen who are not used to online learning. This part provides teachers with more attention to freshmen to improve their learning effect. After the ANOVA test results in F=1.456, P=.231, and null hypothesis 1 cannot be rejected. It shows that there is no obvious difference in the OUK time already enrolled for students' final grades.

Table 6. OUK Time Already Enrolled and Final Test Scores

Years	Number	Percentage	Average Score	Standard Deviation
new student	32	33.68%	78.0	18.6
1	45	47.37%	87.8	14.7
2-3	15	15.79%	84.7	13.7
4-5	2	2.11%	79.5	7.8
>5	1	1.05%	79.0	

4.1.5 Do You Have a Dedicated Computer?

It is found from Table 7 that most of the students at OUK have personal computers. This is because OUK is a school mainly based on distance teaching. Students usually go online for distance learning. It can be seen from Table 7 that the performance of students who do not have a dedicated computer in the course of the "Introduction to Computers Science" is not lower than the students who have a dedicated computer. This is because the content of the course and the quizzes are not actually operated by the computer, but mainly the knowledge content of computer literacy. After the ANOVA test results in F=.429, P=.514, and null hypothesis1 cannot be rejected. It shows that there is no obvious difference in dedicated computers for students' final grades.

Table 7. Dedicated Computers and Final Test Scores

Dedicated computers	Number	Percentage	Average Score	Standard Deviation
Yes	76	80.00%	83.2	15.7
No	19	20.00%	85.9	18.5

4.2 Descriptive Statistics Analysis

4.2.1 Computer Learning Experience

The discussion of students' computer learning experience mainly investigates two questions. One is whether students have ever taken any computer-related course? The other is what are the main motivations for students to learn computers? We will discuss in order.

4.2.1.1 Have Taken in Computer-Related Course

Have you ever taken any computer-related course? This project is a multiple-choice question. The student can indicate that he has taken computer-related course. Whether the student has taken any computer-related course and the final test scores are shown in Table 8. It is found from Table 8 that the average score of students who have taken computer-related course before class is 84.61, and the average score of students who have not taken is 83.96. These scores are very close to the average score of 83.9 for the whole class. This shows that there is no big difference in whether the final test scores have taken computer-related course before the class.

For students who answered that they have taken any computer-related course, further investigate their learning status. The problem of computer-related course that I have taken is multiple choice (a total of 8 options), the results of multiple choices are not helpful for regression analysis. Therefore, we need to establish a single score to represent the measurement of a single student in the computer-related course that have been studied before we can perform subsequent regression analysis. The survey results are shown in Table 9, where the percentage is the ratio of the number of students who selected this option to the number of students who participated in the questionnaire, and the average score is the average score of the students who selected this option. The selected percentage represents the relative importance of this option. The higher the percentage, the more representative this option is, and the average score of students who choose this option is also an important indicator, so we will multiply the average score and the percentage. The result obtained by multiplication is used as the intensity index of the computer-related course that have been taken. This intensity index is called "Pre-learned scores".

The sum of the scores of all computer-related course ever taken by a single student is the student's score on this question. We call this score "COURSE". The student's final grade and "COURSE" were subjected to Person correlation test analysis to obtain a correlation coefficient of 0.113. Regression analysis was performed to obtain R-Square=.013, F-statistics=1.2, P=.276, and null hypothesis 2 could not be rejected.

Table 8. Have You Ever Taken Any Computer-Related Course and Final Test Scores

Ever taken?	Number	Percentage	Average Score	Standard Deviation
No	49	51.58%	82.96	17.73
Yes	46	48.42%	84.61	14.66

Table 9. Taken Computer Course and Final Test Scores

Taken computer course	Number	Percentage	Average Score	Pre-learned scores
Basic Introduction to Computer	24	25.26%	88.1	22.3
Clerical processing	31	32.63%	84.4	27.5
Briefing design and production	13	13.68%	88.5	12.1
Spreadsheet	5	5.26%	94.8	5.0
Drawing software	11	11.58%	85.9	9.9
Computer animation	3	3.16%	84.7	2.7
Programming	1	1.05%	99.0	1.0
Other _____	1	1.05%	50.0	0.5

4.2.1.2 Main Motivation for Learning Computers

What are your main motivations for learning computers? This question is a multiple-choice question with a total of 9 motivation options. Each student's learning motivation may have many items. The relationship between the main motivation for learning computers and the final test scores is shown in Table 10. From Table 10, it is found that the main motivation for students to learn computers is "Strengthen the ability to organize or handle life affairs" for 73.68% of the sample and "To browse and use the Internet function" to account for 54.74%. Since this project is a multiple-choice question, most students have many learning motivations, and it is found that the average score of students with multiple learning motivations is higher than the average score of the whole class, but the difference is not significant.

In order to perform regression analysis, according to the method of dealing with any computer-related course that have been taken in, we established a motivation option intensity indicator called "Motivation scores". The sum of all the scores of multiple motivations selected by a single student is the student's score on this question. We call this score "Motivation". The student's final score and "Motivation" were analyzed by Person correlation test to obtain a correlation coefficient of 0.104. Regression analysis was performed to obtain R-Square=.008, F-statistics=.780, P=.379. Unable to reject null hypothesis 3. It shows that students' learning motivation has no significant relationship with final test scores.

Table 10. Main Motivations and Final Test Scores

Main motivations	Number	Percentage	Average Score	Motivation scores
Can keep up with the trend and avoid falling behind.	31	32.63%	85.0	27.7
Can understand the world where (grandchildren) children live.	9	9.47%	89.0	8.4
It's an interesting thing to try new things.	47	49.47%	85.0	42.1
Strengthen the ability to organize or handle life affairs.	70	73.68%	85.6	63.1
To browse and use the Internet function.	52	54.74%	84.2	46.1
Want to try the computer's entertainment features (e.g., computer games).	26	27.37%	85.2	23.3
Can connect with people more quickly and conveniently.	39	41.05%	84.3	34.6
Go to a community website (e.g., Facebook).	30	31.58%	83.3	26.3
Other_____.	2	2.11%	69.5	1.5

4.2.2 Computer Use Experience

For the discussion of students' computer use experience, it mainly investigates three questions. One is how long the students have used computers? Another is how long do students spend on computer-related equipment (including smartphones) on average every day? The other is what is the purpose of using computer-related equipment most often? We will discuss in order.

4.2.2.1 How Long Have You Been Using the Computer?

It is found from Table 11 that 76.84% of the students have used computers for more than five years, and students who have used computers for more than three years have higher average scores for the final test than the class average. It seems that students who have been using computers for longer will have better grades at the end of the course of the "Introduction to Computers Science". After the ANOVA test results in F=.519, P=.473, and null hypothesis 2 cannot be rejected. It shows that the time that the computer has been used before the class has no obvious difference on the students' final grades.

Table 11. How Long Have You Been Using Computer and Final Test Scores

Years	Number	Percentage	Average Score	Standard Deviation
<1	6	6.32%	79.2	16.2
<3	11	11.58%	82.4	18.7
<5	5	5.26%	85.2	23.4
>5	73	76.84%	84.3	15.7

4.2.2.2 On average, How Long Do You Spend on Computer-Related Equipment Every Day

Table 12 shows the average daily time students spend on computer-related equipment (including smartphones) and final test scores. The answer to this question includes the time spent using smartphones. From Table 12, it is found that 25.26% of students spend more than 7 hours a day on computer-related equipment, 42.1% spend more than 5 hours, 74.73% spend more than 3 hours, and 25.26% of the students spent less than 3 hour. Observing from the final test scores, the test scores of students did not increase with the use of computer-related equipment. After the ANOVA test results in F=.043, P=.837, and null hypothesis 2 cannot be rejected. It shows that the time spent in using computer-related equipment every day which before the course begins has no significant difference on the students' final grades.

Table 12. Average Daily Time Students Spend on Computer-Related Equipment (including Smartphones) and Final Test Scores

Hours	Number	Percentage	Average Score	Standard Deviation
<3	24	25.26%	84.1	17.1
<5	31	32.63%	81.4	17.2
<7	16	16.84%	88.1	13.9
>7	24	25.26%	83.5	15.9

4.2.2.3 Purpose of Using Computer Related Equipment

The purpose of students using computer-related equipment and the final test results are shown in Table 13. This question is a multiple-choice question. From Table 13, 73.68% of the students answered "Watch the OUK online teaching", followed by 56.84% of the students answered "Searching information, watching news" and "Listening to music or watching videos online", 51.58% of the answers to the "E-Mail", 42.11% of the answers to the "Go to a community website" and 41.05% of the answers to "Use software such as clerical processing, briefing design and production, spreadsheet, and drawings". Only 27.37% of the students answered "play online games", and 22.11% of the students answered "Go to the chat room or discussion forum". Observed from the final test scores, the purpose of the students' use of the computer has no obvious relationship with the final test scores.

Refer to the previous way to deal with multi-option problems, and create a computer-used purpose option score called “Purpose scores”. The sum of all the scores of multiple items selected by a single student is the student's score on this question. We call this score “Purpose”. The student’s final grade and “Purpose” were analyzed by Person correlation test, and the correlation coefficient of -0.138 was obtained. Regression analysis was performed to obtain R-Square=.019, F-statistics=1.799, P=.183, and null hypothesis 4 could not be rejected. Explain that the students’ learning purpose has no significant relationship with the final test scores.

Table 13. The Purpose of Students Using Computer-Related Equipment and Final Test Scores

The purpose of using computer-related equipment	Number	Percentage	Average Score	Purpose scores
Send and receive E-Mail.	49	51.58%	84.8	43.7
Watch the OUK online teaching.	70	73.68%	83.3	61.4
Go to the chat room or discussion forum.	21	22.11%	83.9	18.5
Play online games.	26	27.37%	84.5	23.1
Search information, watch news.	54	56.84%	83.8	47.6
Listen to music or watch videos online.	54	56.84%	85.2	48.4
Online shopping.	36	37.89%	82.2	31.2
Go to a community website (such as Facebook).	40	42.11%	85.0	35.8
Use software such as clerical processing, briefing design and production, spreadsheet, and drawings.	39	41.05%	81.8	33.6
other_____.	28	29.47%	87.8	25.9

4.2.3 Personal Feelings and Opinions

For the discussion of students’ personal feelings and opinions on learning computers, it mainly investigates two questions. One is what computer skills the students are most familiar with? The other is do students feel that the technological skills they possess are sufficient? We will discuss in order.

4.2.3.1 Computer Skills Most Familiar to Students

Students think that they are most familiar with the computer skills and final test scores shown in Table 14. This question is a multiple-choice question. From Table 14, 78.49% of the students answered that their most familiar computer skills were “Clerical processing”, 44.09% of the students answered “Basic Introduction to Computers”, and 32.26% of the students answered “Briefing design and production”. In response to “Basic Introduction to Computers” and other higher-skilled student groups, such as “spreadsheets”, “drawing software” and “programming”, the average final test score is much higher

than the average class score. Among them, 3 students answered “Other”, their average score was 58.7 points, which was far lower than the average score of the whole class, 83.9 points. “Other” may be professional information system operation skills at work, such as counter registration and pricing staff in large hospitals, or the cashier in the store, etc., said that students familiar with keyboard and mouse operation skills similar to this type have no advantage over ordinary people in the course of the “Introduction to Computers Science”. This phenomenon is the same as Brock’s et al. (1999) research results. The use of computers only in the workplace does not affect computer literacy, because individuals may only learn one application, such as an electronic form or a single word processing program, and may even only know how to turn on the computer. “Computer” in simple English, they are typists who moved to detached by keyboards and never learned about the computer as we have defined computer literacy.

Refer to the previous way to deal with multi-choice questions, establish a computer skills score that students are most familiar with is called “Skills scores”. The sum of all the scores of the most familiar computer skills selected by a single student is the student's score on this question. We call this score “Skills”. The student’s final grade and “Skills” were subjected to Person correlation test analysis to obtain a correlation coefficient of 0.103. Regression analysis was performed to obtain R-Square=.011, F-statistics=.995, P=.321, and null hypothesis 2 could not be rejected. This shows that there is no significant relationship between the computer skills that students are familiar with before the study and the final test scores.

Table 14. Computer Skills Most Familiar to Students and Final Test Scores

Most familiar Computer skills	Number	Percentage	Average Score	Skills scores
Basic Introduction to Computer	41	44.09%	87.6	38.6
Clerical processing	73	78.49%	83.6	65.6
Briefing design and production	30	32.26%	83.6	27.0
Spreadsheet	6	6.45%	86.2	5.6
Drawing software	4	4.30%	94.8	4.1
Computer animation	1	1.08%	87.0	0.9
Programming	1	1.08%	94.0	1.0
Other _____	3	3.23%	58.7	1.9

4.2.3.2 Do You Think the Technical Skills You Possess Are Sufficient?

This question investigates whether the students think they have enough technical skills they have? The results are shown in Table 15. It is found from Table 15 that 10.53% of the students think that they possess sufficient technical skills, and 89.47% of the students think that they are not enough. The average score of the former group is 88.3 points, which is greater than the latter, and it is much higher

than the average score of the whole class. For the student groups who think that they do not have enough technological skills, we further investigate the course or training that students think they need. The results are shown in Table 16. From Table 16, students who answered that the higher-level skills were insufficient, their average score is higher than the class score, for example: students who answered "Drawing software" and "Computer animation". In addition, 64.21% of students think they need "Briefing design and production", 54.74% think "Spreadsheet", 48.42% think "Clerical processing", it can be seen that most of OUK students think they need to learn office software. Like Kuo's (2020) research, this part can be used as a reference for decision makers in OUK course.

Table 15. Do You Think the Technical Skills You Possess Are Sufficient?

Sufficient?	Number	Percentage	Average Score	Standard Deviation
Yes	10	10.53%	88.3	12.07
No	85	89.47%	83.2	16.65

Table 16. What Course or Training Do You Think You Need Most?

The need most course	Number	Percentage	Average Score
Basic Introduction to Computer	28	29.47%	82.4
Clerical processing	46	48.42%	81.2
Briefing design and production	61	64.21%	83.5
Spreadsheet	52	54.74%	83.7
Drawing software	45	47.37%	85.6
Computer animation	33	34.74%	87.2
Programming	0	0.00%	0

4.3 Computer Attitude

The student's final grade and the score of the computer attitude scale were analyzed by Person correlation test to obtain a correlation coefficient of 0.261. Regression analysis was performed to obtain R-Square=.068, F-statistics=6.793, P=.011. Below 95% confidence level, null hypothesis 5 was rejected. This shows that there is a clear relationship between computer attitude and student's final grade.

4.4 Clerical Software Operation Ability Scale

The student's final grade and the score of the clerical software operation ability scale were analyzed by Person correlation test to obtain a correlation coefficient of 0.047. Regression analysis was performed to obtain R-Square=.002, F-statistics=.21, P=.648, and null hypothesis 6 could not be rejected. This shows that there is no significant relationship between the measurement of clerical software operation ability and the final test scores of students before learning this course.

5. Prediction Model for Final Test

From the results of the discussion of the individual independent variable and the dependent variable above, it is found that in terms of demographic variables, "Age" P<0.05 has the greatest impact on the final test scores, followed by "Education" P=0.063, and other variables have no significant impact on the Computers Science course based on distance teaching. In the analysis of descriptive statistics, it is found that only "Computer attitude scale measurement" has significant impact on the final test scores on the Computers Science course based on distance teaching, and the other variables have no significant impact. However, Afzal et al. (2010) found that there is no significant relationship between individual independent variables and dependent variables. But, there is a significant relationship between the model combining six independent variables and dependent variables. Rex and Roth (1998) found that none of the three measures of computer experience can be used as an important predictor of performance. However, after combining the computer literacy scores, there is a significant relationship between the four independent variable models and learning performance. Therefore, this study hope to establish a set of prediction models that has an important relationship with the final test score is based on the "Introduction to Computers Science" course based on distance teaching from all the independent variables discussed in this research. After multiple regression analysis, a predictive model is established. The multiple regression coefficients of the prediction model are shown in Table 17. This model combined seven independent variables, including "Age", "Education", "Computer attitude measurement", "Motivation", "Course", "Clerical software operation ability scale measurement" and "Skills". Table 17 shows the results of regression analyses with the values of R-Square=.238, F-statistics=3.889, and Significance=.001. The results reveal that the model is significant (p<.05) and there is a strong relationship between independent and dependent variables.

Table 17. Prediction Model for Final Test

Dependent Variables	Unstandardized coefficient		Std. coefficient	t-Value	Sig.
	Estimated value of B	Std. error	Beta distribution		
(Constant)	64.108	16.080		3.987	.000
Education	-7.861	2.381	-.343	-3.301	.001
Age	3.296	1.444	.228	2.282	.025
Motivation	.307	.161	.188	1.906	.060
Clerical software operation ability measurement	-.049	.264	-.021	-.187	.852
Computer attitude measurement	.423	.157	.307	2.695	.008
Skills	-.017	.050	-.035	-.330	.742
Course	.129	.073	.188	1.764	.081
R-Square	.238				
F-Statistic	3.889				
Significance	.001				

6. Results, Limitations, and Future Research

This study explores the relationship between the final test scores and factors, including "demographic variables", "computer learning experience", "computer use experience", "Personal feeling and opinions", "computer attitude scale measurement" and "clerical software operation ability scale measures" in the "Introduction to Computers Science" course based on distance teaching. In terms of the relationship between individual independent variables and final test scores, there is obvious age difference. The computer attitude scale measurement and academic performance show a statistically significant correlation. This result is similar to Klein et al. (1993), but different from Hignite and Echternacht (1992). In addition, there is no direct statistically significant association between the other independent variables and the final test result.

In the questionnaire questions of this research, there are many questions with multiple options. There is no way to perform regression analysis on the data of such multiple options. This research uses weighting to quantify each option in order to obtain a single quantification value of the students in this multiple options question data. A final test score prediction model with 7 independent variables is established in the "Introduction to Computers Science" course based on distance teaching. This is just like previous studies (Afzal et al., 2010; Rex & Roth, 1998), combining some independent variables that have no significant relationship between individual independent variables and dependent variables to establish a significant relationship between the independent variable model and academic performance relationship.

This study has limitations. Only 95 students participated in the questionnaire. The amount of data is slightly insufficient. If we can collect more classes or more semesters of accumulated data, in short, increase the amount of research data, the results obtained will be more practical. Another limitation is that for the data of multiple-choice questions, it is not possible to directly perform regression analysis. In this study, the weighted method is used to generate the option intensity scores of multiple-choice questions to perform regression analysis. This part increases the load of data consolidation and analysis, but it is also the study's important contribution.

From the above results, we know that there are complex and important relationships between factors such as pre-learning computer experience and computer motivation and the learning performance in the "Introduction to Computers Science" course based on distance teaching. Nowadays, in the era of big data, artificial intelligence technology is booming, and it has a strong ability to analyze and calculate complex multiple independent variables and dependent variables. If we can collect enough data, we can consider using machine learning, such as support vector machines, artificial neural networks or deep learning, are used to build predictive models.

7. Conclusion

Due to the diverse sources of OUK students, teachers have insufficient understanding of students' knowledge background, computer experience before class, and learning motivation. In the course of "Introduction to Computer Science" based on distance learning, it is necessary to evaluate students' computer experience and learning motivation before the class. According to the results of this research, students can fill out the 7 independent variable questionnaires used in this research before class. Then, the teacher can predict the student's final academic performance at the beginning of the class based on the prediction model. This can help teachers obtain early warning effects and then provide counseling strategies for students who may not get enough grades at the end of the semester in the "Introduction to Computer Science" course based on distance learning.

In addition to establishing a predictive model that is significantly related to final learning performance, this study also found that although 33% of the students have studied "Clerical processing", 14% have studied "Briefing design and production" and 5% have studied "spreadsheet". And 78% of students said that their most familiar computer skills were "Clerical processing", 32% were for "Briefing design and production" and 6% were for "spreadsheet". But 48% of students still think that the computer course they need most are "Clerical processing", 64% are for "Briefing design and production" and 55% are for "spreadsheet". It can be seen that a large part of the students at OUK are unfamiliar with general office software and feel the need. This result is the same as the Kuo's (2020) study. Similarly, in response to the government of the Republic of China (Taiwan) is promoting the Open Document Format (ODF) through its ODF-CNS15251 policy. And to meet the needs of students, it is recommended that OUK launch Libre Office free software-related course, such as Writer, Impress, and Calc software. Allow OUK students to better meet the expectations and goals of the government and society, and make themselves more competitive in the workplace and adapt to society.

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