Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

Elsevier hereby grants permission to make all its COVID-19-related research that is available on the COVID-19 resource centre - including this research content - immediately available in PubMed Central and other publicly funded repositories, such as the WHO COVID database with rights for unrestricted research re-use and analyses in any form or by any means with acknowledgement of the original source. These permissions are granted for free by Elsevier for as long as the COVID-19 resource centre remains active.
The association of self-control, self-efficacy, and demographic characteristics with home-based E-learning behavior in nursing and midwifery undergraduates: A cross-sectional study under the COVID-19 epidemic

Xinjun Jiang a,b, Hua Zhang a,b, Tao Wang a,*,1, Caihong Zhang a,*,1

a School of International Nursing, Hainan Medical University, No.3 Xueyuan Road, Longhua District, Haikou, Hainan Province 571199, China
b Key Laboratory of Emergency and Trauma Ministry of Education, Hainan Medical University, No.3 Xueyuan Road, Longhua District, Haikou, Hainan Province 571199, China

A R T I C L E   I N F O

Keywords:
Self-control
Self efficacy
Home isolation
COVID-19
Coronavirus

A B S T R A C T

Background: During the coronavirus disease 2019 (COVID-19) pandemic, nursing and midwifery undergraduate students’ time spent in home isolation and being engaged in home-based e-learning was extended. Limited research has been conducted on home-based e-learning behavior during home isolation, and the relationships between individual factors, such as self-control, self-efficacy, and other demographic characteristics, and home-based e-learning behavior are unclear.

Objectives: This study aimed to explore the associations between self-control, self-efficacy, and demographic information with home-based e-learning behavior among nursing and midwifery undergraduates during the COVID-19 pandemic.

Design and methods: A cross-sectional study was employed, and an online survey was conducted with 3733 nursing and midwifery undergraduates across seven provinces and cities in mainland China. Data were collected using the Brief Self-control Scale, General Self-efficacy Scale, Undergraduate Home-based E-learning Behavior Questionnaire, and Demographic Information Questionnaire. A multiple linear regression analysis using the stepwise method was conducted to identify predictors of home-based e-learning behavior.

Results: Undergraduates achieved an overall mean score of 26.02 (SD = 4.20) for home-based e-learning behavior and an overall mean score of 42.54 (SD = 6.22) and 27.59 (SD = 3.89) for self-control and self-efficacy, respectively. Better self-control (β = 0.250, P < 0.001), higher self-efficacy (β = 0.169, P < 0.001), universities being located in non-Hainan provinces (β = 0.249, P < 0.001), being a sophomore or freshman (β = 0.255, P < 0.001), and good perceived health status (β = 0.044, P = 0.003) were identified as the predictors of better home-based e-learning behavior among nursing and midwifery undergraduates.

Conclusion: Self-control, self-efficacy, and demographic characteristics including the province of the university, grade level, and personal perceived health status were associated with home-based e-learning behavior. Universities should help nursing and midwifery undergraduates improve self-control and enhance self-efficacy while taking measures to decrease the impact caused by demographic characteristic differences.

1. Introduction

Coronavirus disease 2019 (COVID-19) is a global pandemic posing a severe threat to public health. According to the World Health Organization, the number of confirmed cases and deaths worldwide due to COVID-19, as of March 17, 2022, exceeded 476 million and 6.1 million, respectively (World Health Organization, 2022). National blockade and social distancing among citizens caused by the COVID-19 pandemic had a significant impact on education, work, social activities, and economic functioning. Regarding education, schools at all levels were forced to
close during the pandemic (The World Bank, 2022). As of May 30, 2021, schools were still reportedly closed in 23 countries, which affected >2.02 million students including nursing and midwifery undergraduates. By February 28, 2022, COVID-19 continued to affect 2.8% of the total number of students enrolled worldwide, resulting in school closures in six countries (UNESCO, 2022).

Due to the widespread of COVID-19 in China in the early spring of 2020, as in many other countries (Sahu, 2020; Burki, 2020), the Chinese Ministry of Education extended home isolation and enforced the closure of schools and universities (Ministry of Education of People's Republic of China, 2020). In response to the government's request for continued learning and teaching, undergraduate students studied at home with the aid of the Internet (Ministry of Education of People's Republic of China, 2020). It was unprecedented for such a large number of undergraduates to shift from traditional classroom learning to home-based e-learning for such a large number of undergraduates. Therefore, e-learning or home-based e-learning (HBEL) has gained significant attention.

HBEL is an e-learning format wherein learning occurs at home via the internet, which allows for physical separation between the individual and their social environment. It was unprecedented for such a large number of undergraduates to engage in HBEL behavior. A cross-sectional study in Ethiopia identified low levels of self-efficacy among undergraduate students who were re-entering campus during the COVID-19 pandemic (Tadese and Mihretie, 2021). Moreover, self-efficacy influences study processes and learning performances both directly and indirectly (Hayat et al., 2020; Gristan et al., 2019; Wang et al., 2021b; Kumar et al., 2021). A systemic review suggested that self-efficacy was closely related to self-directed learning (Wong et al., 2021). However, the relationship between self-efficacy and HBEL behavior needs to be determined. In addition, the demographic characteristics (e.g., province of university, grade level, and others) of undergraduates may also have an impact on HBEL behavior (Jiang et al., 2020; Wang et al., 2020).

In summary, nursing and midwifery undergraduates were quarantined at home and received HBEL during the COVID-19 pandemic, making it difficult for them to ensure the quality of learning, it is consequently necessary to focus on the HBEL behavior of undergraduate students. However, research on the HBEL behavior of nursing and midwifery undergraduate students and its influencing factors is scarce. Therefore, this study aimed to explore the associations between self-control, self-efficacy, and demographic characteristics with home-based e-learning behavior among nursing and midwifery undergraduates.

3. Methods

3.1. Study design and participants

A cross-sectional study was conducted in 2020 across colleges/universities in Mainland China. Convenience sampling was performed to collect the data from universities distributed across nine provinces and cities including Hainan, Anhui, Beijing, Shandong, Hunan, Hubei, Shanxi, Zhejiang, and Guangdong. Full-time undergraduate students from colleges and universities who were willing to participate in the survey were included and undergraduates with no access to the Internet were excluded. This article presented secondary data analyses based on the cross-sectional study and study procedures detailed in a previous study (Jiang et al., 2020). The report of this study was guided by the STROBE checklist for an observational study.

3.2. Indicators and measurement

3.2.1. Self-control

Self-control was measured using the Brief Self-control Scale. The 13-item Brief Self-control Scale was developed by Tangney et al. (2004) (Tangney et al., 2004), and was translated and adjusted by Yi (2013). The scale included two subscales of self-discipline and impulse control. The score for each item was derived after adopting a five-point Likert

2

X. Jiang et al. Nurse Education Today 120 (2023) 105628
scale. For example, the choices for the item “I am good at resisting temptation” ranged from “not at all” to “very much,” and the scores were assigned between 1 and 5 points; the total score ranged from 13 to 65 points. A higher score indicates better self-control. The two subscales of self-discipline and impulse control were composed of five and eight items, respectively. Their total mean score ranged from 0.6 to 3.6, 1 to 4, 1 to 4, and 1 to 4, respectively. The Cronbach’s α coefficient of the scale in this study was 0.77.

3.2.2. Self-efficacy

Self-efficacy was evaluated using the General Self-efficacy Scale. The English version of the General Self-efficacy Scale was developed by Schwarzer et al. (1997) (Schwarzer et al., 1997), while the Chinese version was translated and adapted by Wang (Wang et al., 2001). The scale contains 10 items and the score of each item ranges from one to four points. For instance, the choices for item “I can always manage solving difficult problems if I try hard enough” ranged from “not true” to “true,” and the scores were assigned between one to four points. The total score for the scale was within the range of 10 to 40 points. A higher score indicates higher self-efficacy. The Cronbach’s α coefficient of the scale in this study was 0.77.

3.2.3. HBEL behavior

HBEL behavior was assessed using an undergraduate HBEL behavior questionnaire designed by Jiang et al. (Jiang et al., 2020). The design of the questionnaire was based on a literature review and online interviews with several students, and it was verified by experts. Some improvements and revisions were made after conducting a small-scale pilot survey. The questionnaire was used to assess the HBEL of undergraduates during isolation. It contained ten items divided across four dimensions, including online curriculum learning (e.g., the content, frequency, approach, and method of learning), learning time, concentration, and satisfaction of learning behavior. Two items of HBEL content and approach to learning were assessed by multiple choice questions. Scores ranged from zero to three and were assigned by adding one point for each additional learning component or approach. Further, two more items on the dimension of online curriculum learning, as well as the dimensions of learning time, concentration, and satisfaction of learning behavior were scored using a five-point Likert scale. For instance, if the satisfactory for HBEL behavior was extremely dissatisfied, dissatisfied, satisfied, or very satisfied, they were scored on a scale of one to four, respectively. The total score for HBEL ranged from 8 to 38; a higher score indicated better HBEL behavior. A total score of >29, 19 to ≤29, and ≤19 indicated high, medium, and low levels of HBEL behavior, respectively. The four dimensions of online curriculum learning, learning time, concentration, and satisfaction of learning behavior were composed of five, two, one, and two items, respectively. Their total mean score ranged from 0.6 to 3.6, 1 to 4, 1 to 4, and 1 to 4, respectively. The Cronbach’s α coefficient and test-retest reliability of the questionnaire were 0.74 and 0.94, respectively.

3.2.4. Demographic information

Participants' demographic information was collected using a self-designed questionnaire. The questionnaire was created after conducting a literature review and refined after expert discussion and a small-scale preliminary survey. It covered eight main items, including age, gender, place of residence, the university's province, type of university, major, grade level, and the personal perceived health status of the undergraduate students.

3.3. Data collection

From March to April 2020, a nationwide online survey was conducted with the assistance of “WenJuan Xin” software (https://www.wjx.cn/). The electronic questionnaires developed using this software were distributed to universities for researchers to communicate. Undergraduates independently completed the online questionnaire using their mobile phones and computers by anonymously self-reporting. The questionnaire could only be submitted once it was completed. Each Internet protocol address could only be submitted once. The researchers could access the data from the questionnaires on the “WenJuan Xin” platform.

3.4. Ethics considerations

The study was approved by the ethics committee of Hainan Medical University (hyll-2020-011) and was conducted in accordance with the principles of the Declaration of Helsinki. Since the study data were collected online using the “WenJuan Xin” software, the guidelines were displayed on the first page of the electronic questionnaire, that is, it stated the purpose, significance, and confidentiality principle of the study. Those who completed and submitted the questionnaire were considered to have provided their informed consent.

3.5. Data analysis

IBM SPSS version 25.0 was used for the data analysis. Descriptive statistics, such as frequency, proportion, mean, and standard deviation were used to present basic demographic information. Two independent t-tests, Pearson's correlation analysis, and multiple linear regression analysis using the stepwise method with P-in = 0.05 and P-out = 0.1 were conducted for statistical inference. A P value below 0.05 indicated that the difference was statistically significant for all analyses.

4. Results

4.1. Demographic characteristics of participants

A total of 5435 questionnaires were collected from undergraduate students in the nationwide cross-sectional study, with 5309 valid questionnaires identified after the exclusion of 126 questionnaires. The effective recovery rate was 97.7 %. Of the 5309 undergraduate students, 3733 (70.31 %) nursing and midwifery undergraduate students completed the questionnaire. The nursing and midwifery undergraduate students were from seven provinces and cities across China. Nursing and midwifery undergraduates aged 20 years or younger accounted for 59.79 %. Of these, females accounted for 88.70 %, with 2364 students (63.33 %) living in rural areas, 1965 students (52.64 %) were medical college/university students, and 2032 students (54.43 %) were from universities in Hainan province. Of these, 2648 students (70.93 %) were freshmen and sophomores, and 96.46 % of the undergraduate students perceived themselves as being in good health (Table 1). The mean difference in HBEL behavior was found to be significant concerning age, university province, grade level, and perceived health status (P < 0.05). The results are shown in Table 1.

4.2. Self-control, self-efficacy, and HBEL behavior

The overall scores for self-control, impulse control, and self-discipline were 42.54 (SD = 6.22), 26.42 (SD = 5.52), and 16.14 (SD = 2.28), respectively (Table 2). The overall score for self-efficacy was 27.59 (SD = 3.89, Table 2). The overall mean score of HBEL behavior for undergraduates was 26.02 (SD = 4.20, Table 2). The proportion of high, medium, and low levels of HBEL behavior for undergraduates was 20.89 %, 72.41 %, and 6.70 %, respectively. The mean scores of the items for four dimensions including online curriculum learning, learning time, concentration, and satisfaction of learning behavior were 2.31 (SD = 0.52), 3.15 (SD = 0.64), 2.94 (SD = 0.94), and 2.61 (SD = 0.63), respectively.
4.4. Linear regression analysis

with self-control, self-efficacy, and HBEL behavior, respectively (Note: graduate students’ scores of HBEL behavior as a dependent variable and relation between self-control, self-efficacy, and HBEL behavior (−)).

4.3. Correlations between self-control, self-efficacy, and HBEL behavior

The results of Pearson’s correlation analysis revealed a positive correlation between self-control, self-efficacy, and HBEL behavior (P < 0.05, Table 2). Subscales of self-control, namely, impulse control and self-discipline were also found to have significant positive correlations with self-control, self-efficacy, and HBEL behavior, respectively (P < 0.05, Table 2).

4.4. Linear regression analysis

A multiple linear regression analysis was conducted using undergraduate students’ scores of HBEL behavior as a dependent variable and the variables with statistically significant differences (P < 0.05) in the univariate analysis as independent variables. The methods of assigning independent variables are detailed as follows: Age: original variable; University Province: Hainan province = 1, non-Hainan province = 2; Grade level: ≤ sophomore = 1, ≥ junior = 2; Perceived health status: well and above = 1, not very well and below = 2. The results of the multiple linear regression analysis showed that self-control (β = 0.250, P < 0.001), self-efficacy (β = 0.169, P < 0.001), university province (β = 0.249, P < 0.001), grade level (β = −0.255, P < 0.001), and personal perceived health status (β = −0.044, P = 0.003) were independent influential factors for the HBEL behavior of nursing and midwifery undergraduate students (P < 0.05, Table 3).

5. Discussion

The nationwide cross-sectional study was conducted across seven provinces and cities in China; its results on nursing and midwifery undergraduate students’ HBEL behavior revealed relationships between variables including self-control, self-efficacy, university province, grade level, and perceived health status associated with HBEL behavior. Thus, the findings would help guide targeted assistance for nursing and midwifery undergraduate students caught in self-imposed isolation during COVID-19.

The overall mean score of the HBEL behavior of the undergraduate students in this study indicated a moderate level. This suggests that the HBEL behavior of undergraduate students needs to be improved. Despite the lacking number of studies conducted on undergraduates’ HBEL during the pandemic, it was found that high school students had more positive attitudes toward HBEL compared to students in middle and primary school (Wang et al., 2020). This may indicate that those with higher education are more receptive to HBEL. A qualitative study demonstrated that nursing undergraduates acknowledged their HBEL experiences positively (Hu et al., 2022). Therefore, although it is new for such a large number of nursing and midwifery undergraduates to study at home, the HBEL behavior of undergraduates was acceptable. Nevertheless, there remains room for improvement. The current study also found that the highest and lowest mean scores of each item pertaining to the four dimensions of HBEL were learning time, and online curriculum learning. This might imply that too many online learning courses should not be scheduled during home isolation, considering that undergraduate students might need to spend more time studying online due to technical issues with the Internet, network problems, and other distractions.

This study demonstrated that higher self-control was associated with

| Variables | n (pro, %) | Scores of HBEL behavior (mean ± SD) | t value | P value |
|-----------|-----------|-----------------------------------|---------|---------|
| Age, year |           |                                   |         |         |
| ≤20       | 2232      | 26.33 ± 4.18 (59.79 %)            | 5.593   | <0.001  |
| >20       | 1501      | 25.55 ± 4.20 (40.21 %)            |         |         |
| Gender    |           |                                   |         |         |
| Female    | 3311      | 26.05 ± 4.14 (88.70 %)            |         |         |
| Male      | 422       | 25.80 ± 4.69 (11.30 %)            | 1.137   | 0.256   |
| Residence |           |                                   |         |         |
| Rural area| 2364      | 25.98 ± 4.20 (63.33 %)            | −0.742  | 0.458   |
| Cities and towns | 1369 | 26.08 ± 4.21 (36.67 %) |         |         |
| University province | | | | |
| Hainan province | 2032 | 25.52 ± 4.27 (54.43 %) | −7.937  | <0.001  |
| Non-Hainan province | 1701 | 26.61 ± 4.05 (45.57 %) |         |         |
| Type of university | | | | |
| Medical | 1965 | 25.89 ± 4.36 (52.64 %) | −1.948  | 0.051   |
| Non-medical | 1768 | 26.16 ± 4.01 (47.36 %) |         |         |
| Grade level | | | | |
| ≤ Sophomore | 2648 | 26.52 ± 4.12 (70.93 %) | 11.644  | <0.001  |
| ≥ Junior | 1085 | 24.79 ± 4.14 (29.07 %) |         |         |
| Health status | | | | |
| ≥ well | 3601 | 26.09 ± 4.17 (96.46 %) | 5.190   | <0.001  |
| ≤ not very well | 132 (3.54 %) | 24.16 ± 4.71 | | |

Note: HBEL: home-based e-learning; university province, the province where university is located; Health status, personal perceived health status; pro, proportion; SD, standard deviation.

### Table 2

Correlations between study variables (N = 3,733).

| Variables | Mean ± SD | Min | Max | HBEL behavior | Self-efficacy | Self-control | Impulse control | Self-discipline |
|-----------|-----------|-----|-----|---------------|---------------|--------------|----------------|----------------|
| HBEL behavior | 26.02 ± 4.20 | 11 | 38 | 1 | | | | |
| Self-efficacy | 27.59 ± 3.89 | 10 | 40 | 0.238*** | | | | |
| Self-control | 42.54 ± 6.22 | 24 | 65 | 0.296*** | 0.227*** | 1 | | |
| Impulse Control | 26.40 ± 5.52 | 8 | 40 | 0.237*** | 0.052** | 0.932*** | 1 | |
| Self-discipline | 16.14 ± 2.28 | 9 | 25 | 0.235*** | 0.495*** | 0.475*** | 0.123*** | 1 |

Note: HBEL: home-based e-learning; Min: minimum; Max: maximum. * P < 0.05, ** P < 0.01, *** P < 0.001.

### Table 3

Multiple linear stepwise regression analysis on HBEL behavior (N = 3,733).

| Variables | B value | Standard error | β value | t value | P value |
|-----------|---------|----------------|---------|---------|---------|
| Constant | 14.815 | 0.727 | 0.044 | 20.378 | <0.001 |
| University province | 2.099 | 0.135 | 0.250 | 15.572 | <0.001 |
| Grade level | 2.356 | 0.148 | 0.255 | −0.316 | <0.001 |
| Health status | −1.002 | 0.336 | −0.249 | −2.978 | 0.003 |
| Self-efficacy | 0.182 | 0.016 | 0.169 | 11.168 | <0.001 |
| Self-control | 0.169 | 0.010 | 0.250 | 16.449 | <0.001 |

Note: 1) University province, the province where university is located; Health status, personal perceived health status; 2) R value = 0.445; R² value = 0.198, adjusted R² = 0.197, F = 183.731, P < 0.001.
better HBEL behavior among nursing and midwifery undergraduates, suggesting that self-control was a crucial factor in ensuring HBEL. HBEL requires nursing and midwifery undergraduates to study alone at home via the internet, leading to a lack of supervision from teachers and interaction with classmates. A previous study has revealed that students with higher self-control were more likely to perform better academically (Tangney et al., 2004), and undergraduate students with strong self-control were linked to a low level of Internet addiction (Mei et al., 2016; Enyuan and Huiyu, 2017). In addition, the overall total mean score of students’ self-control indicated a moderate level. Therefore, to meet the challenge posed by COVID-19 and the rapid growth of the Internet, measures/interventions should be taken to promote self-control among nursing and midwifery undergraduate students. Duckworth et al. summarized some strategies that could facilitate self-control in e-learning (Duckworth et al., 2019). Strategies include telling students to eliminate possible temptations (e.g., blocking social media apps and muting phones) from their immediate sight before online classes begin, setting deadlines for assignments, and informing students to plan ahead, which are also applicable for nursing and midwifery undergraduate students.

The results also found that a high level of self-efficacy predicted good HBEL behavior. Furthermore, the findings in this study showed that undergraduate students’ self-efficacy levels were moderate. Individuals with a higher level of self-efficacy are more self-confident and successfully conquer the difficulties of studying online while being quarantined at home. Therefore, the self-efficacy of undergraduate students needs to be strengthened in the landscape of the COVID-19 pandemic as well as in routine teaching. According to the Social Cognitive Theory (Bandura, 1997), an individual’s self-efficacy can be enhanced using interventions that adequately incorporate four sources of information, namely performance accomplishments, vicarious experience, verbal persuasion, and emotional arousal. A systematic review and meta-analysis, and other original studies (Jiang et al., 2019a; Jiang et al., 2021; Jiang et al., 2019b), have indicated that self-efficacy-focused education combining these four sources of information could also improve metabolic control, diabetes self-efficacy and other psychological indicators for patients with diabetes. Thus, it may be feasible to develop an intervention based on all four sources of information to assist in enhancing nursing and midwifery undergraduate students’ self-efficacy. In addition, several strategies can be applied to the aforementioned four sources of information. For example, a study conducting a simulation with repetitive strategies could assist students in improving their self-efficacy, while also acquiring clinical knowledge and skills (Algharibi et al., 2021). In addition, other strategies may be used as viable options when designing and implementing interventions, including assisting students in setting progressive and realistic goals, assigning tasks based on difficulty (from easy to difficult), encouraging students, providing them with positive feedback, and sharing their experience, to help them to step-by-step build confidence.

In addition, this study demonstrated that university students’ score of HBEL behavior in the Hainan province was inferior to that in non-Hainan provinces. This may be owing to the relative lagging economic and educational development in this province in China (He et al., 2021; Qi, 2020), which results in relatively outdated online platforms and a poor learning atmosphere in universities. Other provinces and regions with similar conditions may also have such problems. Therefore, investing in the construction of educational networks in underdeveloped areas and the local or national government is necessary. Additionally, there is a need to strengthen the learning awareness and atmosphere among undergraduate nursing and midwifery students.

In this study, it was found that the outcome of HBEL behavior for junior and senior students was poorer than for sophomore and freshman students. This may be attributed to the different needs and concerns of students across different grade levels. Compared to sophomore and freshman students, junior and senior nursing and midwifery undergraduate students face challenges arising from practicum, continuing education, and employment, which may hinder them from using HBEL. Therefore, it is necessary for universities to provide them with added online support and resources, such as online internship training and guidance and career fairs, among others. Thus, these juniors’ and seniors’ needs can be met while their concerns are allayed.

Additionally, perceived health status was indicated as another significant factor for HBEL behavior. This could be attributed to healthy undergraduates having more energy to focus on studying at home. In addition, most students may not have physical ailments or diseases, but may instead experience negative emotions such as anxiety and stress. An online survey of 89,588 college students in China during the COVID-19 pandemic demonstrated that 41.1 % of students experienced anxiety symptoms (Fu et al., 2021). Another online survey indicated that 82.3 % of medical students had moderate to high levels of stress while engaging in online learning during COVID-19 (Wang et al., 2021a). Students’ health status may be affected by high levels of negative emotions, which also affect their learning at home. Thus, providing timely and targeted psychological interventions to all students during the pandemic, especially during the home isolation period, is critical.

5.1. Strengths and limitations

This study had several strengths, including the fact that the study was a nationwide survey with a large number of participants. To the best of our knowledge, this is the first study in China to focus on the HBEL behavior of nursing and midwifery undergraduate students during the COVID-19 pandemic. This study sheds light on the HBEL behavior of undergraduates and its influencing factors and acts as a reference point for other countries and regions with similar conditions. Simultaneously, the findings provided strong implications for future online learning concerning nursing and midwifery undergraduate students and can also be applied to other streams. Moreover, the findings of this study also provide empirical evidence supporting the relationship between the individual factors of self-control, self-efficacy, demographic characteristics, and HBEL behavior, as per the Social Cognitive Theory. However, this study has some limitations that must be addressed. This study is a cross-sectional study, meaning it did not reflect changes in the HBEL behavior during the pandemic. Therefore, a longitudinal study is needed to further explore this specific situation. In addition, because of the prevalence of COVID-19, data collection relied on access to online services and self-reporting, which implies that the results may be influenced by social desirability. Meanwhile, other factors such as family support and ongoing faculty support that may influence home-based e-learning behavior were not investigated in this study as this was an online survey, as well as other time constraints.

6. Conclusions

The HBEL behavior of undergraduates requires improvement. Self-control, self-efficacy, and some demographic variables including the province of university, grade level, and perceived health status are associated with home-based e-learning behavior. The study’s results showed that universities should assist nursing and midwifery undergraduates in improving self-control and enhancing self-efficacy to resist temptations and conquer difficulties when receiving HBEL during the COVID-19 pandemic. Furthermore, strategies such as informing students to avoid distractions on the Internet, enabling them to make plans/goals ahead of time, setting deadlines, and assigning tasks on a gradual basis can be adopted by universities. In addition, increasing educational network constructions, providing targeted online resources for different grade levels of undergraduates, and providing timely psychological interventions may also contribute to reducing the impact of differences in the university’s province, grade level, and personal perceived health status.
The study was supported by the Project of Educational Science Research of Hainan Medical University (HY2020111, HYZD2021111), and the Project of Educational Science Research of Hainan Province (HnjgS2022-8, Hnjg2022DD-3), and the Teaching Achievement Award Cultivation Project of Hainan Medical University (HJyjcx202211).

Ethics approval

The study was approved by the ethics committee of Hainan Medical University (hyll-2020-011).

Declaration of competing interest

The authors declared that there was no conflict of interest.

Acknowledgements

The authors thank to the students who have received the survey, and also thank to the universities and colleges participated in the investigation.

References

Al Gharibii, K.A., Schmidt, N., Arulappan, J., 2021. Effect of repeated simulation experience on perceived self-efficacy among undergraduate nursing students. Nurse Educ. Today 106, 105057. https://doi.org/10.1016/j.nedt.2021.105057.

Allemand, M., Job, V., Mroczek, D.K., 2019. Self-control development in adolescence predicts love and work in adulthood. J. Pers. Soc. Psychol. 117 (3), 621–634. https://doi.org/10.1037/pspa0000229.

Bandura, A., 1977. Self-efficacy: toward a unifying theory of behavioral change. Psychol. Rev. 84 (2), 191–215.

Bandura, A., 1997. Self-efficacy: The Exercise of Control. W.H. Freeman and Company.

Bandura, A., Adams, N., 1977. In: Analysis of self-efficacy theory of behavioral change, 1 (4), pp. 287–310. https://doi.org/10.1002/0470663995.

Bao, W., 2020. COVID-19 and online teaching in higher education: a case study of Peking University. Hum. Behav. Emerg. Technol. 2 (2), 113–115. https://doi.org/10.1002/hbte.2191.

Burki, T.K., 2020. COVID-19: consequences for higher education. Lancet Oncol. 21 (6), 758. https://doi.org/10.1016/S1470-2045(20)30287-4.

Duckworth, A.L., Tucker, J.L., Edreki-Winkler, L., Galla, B.M., Gross, J.J., 2019. Self-control and academic achievement. Annu. Rev. Psychol. 70, 373–399. https://doi.org/10.1146/annurev-psych-011418-103230.

Enyanu, Z., Huiyu, Z., 2017. An empirical study of college students’ subjective well-being, self-control and internet addiction. J. Grad. Sch. Chin. Acad. Soc. Sci. 17, 24.

Fu, W., Yan, S., Zong, Q., Anderson-Luxford, D., Song, X., Lv, Z., et al., 2021. Mental health, academic self-efficacy and self-control: a national survey during the COVID-19 pandemic. Curr Psychol. 1–11. https://doi.org/10.1007/s12144-021-00253-3 (New Brunswick, N.J.).

Mei, S., Yau, Y.H.C., Chai, J., Guo, J., Potenza, M.N., 2016. Problematic internet use, well-being, self-esteem and self-control: data from a high-school survey in China. Addictive behaviors. 61, 74–79. https://doi.org/10.1016/j.addbeh.2016.05.009.

Ministry of Education of People’s Republic of China, 2020. The Ministry of Education issued a guideline to organize and manage online teaching in colleges and universities during the epidemic prevention and control period. http://www.moe.gov.cn/jyb_xwfb/gzdt_gzdt/s5987/202002/t20200205_418131.html. Accessed 2022-3-27, 2020.

Oaten, M., Cheng, K., 2005. Academic examination stress impairs self-control. J. Soc. Clin. Psychol. 24 (2), 254–279. https://doi.org/10.1521/jscp.24.2.254.32711.

Qi, S., 2020. Economy develops unbalanced current situation analysis of provinces in our country. Marketing Industry. 19, 110–111.

Rideout, V., Robb, M., 2019. The Common Sense Census: Media Use by Tweens And Teens. 2019. Common Sense Media, San Francisco.

Robert, J.J., Yaya, L.H., Manolis, C., 2014. The invisible addiction: cell-phone activities predicts love and work in adulthood. J. Pers. Soc. Psychol. 117 (3), 621–643. https://doi.org/10.1037/a0033532.

Roberts, J.A., Yaya, L.H., Manolis, C., 2014. The invisible addiction: cell-phone activities predicts love and work in adulthood. J. Pers. Soc. Psychol. 117 (3), 621–643. https://doi.org/10.1037/a0033532.

Tadese, M., Mihretie, A., 2021. Attitude, preparedness, and perceived self-efficacy in controlling COVID-19. PLoS One 16 (9), e25511 https://doi.org/10.1371/journal.pone.0255111.

Tan, J., 2022. Profound changes in the Chinese version of general self-efficacy scale. Chin. J. Appl. Psychol. 7, 37-99. https://doi.org/10.1002/psp.2020.09.017.

Tangney, J.P., Baumeister, R.F., Boone, A.L., 2004. High self-control predicts good adjustment, less pathology, better grades, and interpersonal success. Journal of personality 72 (2), 271–324. https://doi.org/10.1111/j.0027-3998.2004.00287.x.

The World Bank, 2022. The COVID-19 pandemic: shocks to education and policy responses. https://www.worldbank.org/en/topic/education/publication/the-covid-19-pandemic-shocks-to-education-and-policy-responses. Accessed 2023-2-37.

UNESCO, 2022. Education to recovery from disruption. https://www.unesco.org/en/covid19/educationresponse. Accessed 2023-3-27.

Wang, K., Mihretie, A., 2021. Attitude, preparedness, and perceived self-efficacy in controlling COVID-19. PLoS One 16 (9), e25511 https://doi.org/10.1371/journal.pone.0255111.

Tangney, J.P., Baumeister, R.F., Boone, A.L., 2004. High self-control predicts good adjustment, less pathology, better grades, and interpersonal success. Journal of personality 72 (2), 271–324. https://doi.org/10.1111/j.0027-3998.2004.00287.x.

The World Bank, 2022. The COVID-19 pandemic: shocks to education and policy responses. https://www.worldbank.org/en/topic/education/publication/the-covid-19-pandemic-shocks-to-education-and-policy-responses. Accessed 2023-2-37.

Wang, K., Mihretie, A., 2021. Attitude, preparedness, and perceived self-efficacy in controlling COVID-19. PLoS One 16 (9), e25511 https://doi.org/10.1371/journal.pone.0255111.