

## Effect of Interactive Digital-Based Educational Intervention on knowledge, Misconceptions, and Preventive Practices of COVID -19 among Damanhour University Students

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### Abstract:

**Background:** The pandemic of COVID-19 is currently a threat to global health. Prevention and control largely depend on population awareness and behavior. **Aim:** Evaluate the effect of interactive digital-based educational intervention on knowledge, misconceptions, and preventive practices of COVID -19 among Damanhour university students. **Methods:** A randomized controlled educational trial design was employed (pre-post-test/control group). The study was accomplished in four literature faculties in Damanhour University, where 400 students were equally and randomly allocated into intervention and control groups by using multi stage sampling technique. Online structured questionnaire was used contained three tools: students' knowledge and misconceptions toward COVID-19, students' preventive practices toward COVID-19, and students' satisfaction scale with the educational intervention. **Results:** A statistically significant positive mean change was found for total COVID-19 knowledge and preventive practices scores after one and three months of the educational intervention. A statistically significant negative mean change was observed for the total misconceptions score after one and three months of the educational intervention. COVID-19 preventive practices were found to be positively correlated with total knowledge ( $r=0.768$ ,  $P=0.000$ ) while it was negatively correlated with total misconception ( $r=-0.541$ ,  $P=0.003$ ) scores. A higher satisfaction with the overall COVID-19 digital-based educational intervention was found among 75.0% of the intervention group. **Conclusion:** of the present study support the research hypotheses and the digital-based educational intervention was effective in improving university students' COVID-19 knowledge and preventive practices and lowering their misconceptions. Henceforth, expanding the experience of digital-based health educational programs about COVID-19 is recommended to improve the community practices and enhance their self-reliance and empowerment to combat the disease.

**Keywords:** COVID-19, Interactive Digital-Based Education, Knowledge, Preventive Practices, Misconceptions, faculty students, Damanhour University

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### Introduction

In December 2019, a hurriedly infectious disease materialized in Wuhan city in China. The disease was induced by an affiliate of Corona viruses' family, named Severe Acute Respiratory Syndrome Corona virus 2 (SARS-CoV-2).

The extremely contagious virus produced the disease named Corona virus disease (COVID-19), spread outside China, and has since become a global public health emergency (Shigemura et al., 2020). On 11 March, the WHO announced the novel COVID-19 outbreak as a global pandemic. In October 2020, WHO's updates a new

gush of COVID-19 that has now spread to over 235 areas, countries, and territories, with over 56 million persons contracting the virus. Consequently, over 1 million worldwide deaths occurred, with great suffering from the economic, physical, and mental health consequences of COVID-19 (WHO, 2020). By the end of November 2020, over 114,475 confirmed cases, 6596 fatalities, and a rapid tendency towards increase in Egypt (Egyptian PM, 2020). The COVID-19 cases can experience minimal to moderate respiratory illness and get better without necessitating special treatment. Critical illness is more likely among the elderly and chronically ill patients and those who have chronic respiratory disease, diabetes, cardiovascular disease, and cancers (WHO Corona virus pandemic, 2020). A dangerous problem confronting the health system was the asymptomatic carriers who have been suspected and detected, where estimates suggested that they could represent about 60% of all COVID-19 infections. Simultaneously, Zou et al. discovered that asymptomatic carriers might be highly contagious during the incubation period because their viral load was nearly identical to symptomatic patients (Zou et al., 2020).

Most of the people were completely unaware of the impending crisis during the disease's initial stages. As the number of infections and deaths rose and the severity of the situation gradually became evident. It soon became known that this will be a long-haul war. People were left deprived of face-to-face social connections with the imposition of lockdown and self-quarantine. These interruptions in human interaction and communication are causing individuals to lose their sense of control; in addition to that, over the past period, the new Corona virus has provided a fertile environment for spreading misleading news stories,

which carried many false rumors about the virus (Sarangi et al., 2020).

Till the moment, there is no proven treatment or vaccination against COVID-19. Robust infection control measures are the major intervention to minimize the circulation of the virus in healthcare settings and the community. Community awareness of dealing with highly infectious respiratory diseases plays a dynamic role in limiting the spread of the infection, specifically in middle and low-income countries, wherever health systems have, at best, the moderate capacity to react to outbreaks. The situation in which health education plays a determinant role in supporting the health system efforts and fostering disease containment strategies through raising public awareness and risk perception with COVID-19. Moreover, evidence showed that combining health education with modern digital technologies yield a more positive and efficient impact. One of the main gains of digital education is that with very little expense, a range of educational knowledge can be transmitted to people all over the world instantaneously (Li J, 2020 & Cadmus-Bertram et al., 2016).

Community health nursing specialty has a critical role in health education and dissemination of COVID-19 preventive practices. Several variables, such as diverse cultures, large socio-economic disparities, and inequalities in healthcare services, can present challenges in implementing these preventive practices at the community level (The Lancet, 2020).

### **Significance of study**

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The pandemic can remain in the future and the exacting adoption of preventive practices is the only crucial way to reduce the spread of the disease, it

is of dominant importance to assess the extent of adopting preventive practices against COVID-19 by using advanced and experimental study design that match the growing technological era. The current study could help fill the current knowledge gap about the newly emerging COVID-19 due to the scarcity of evidence, especially the misconceptions and the digital educational intervention application. Over and above, opportune and regular education of the preventive practices dutifully might help formulate effective strategy and policy (Roy et al., 2020, Chopra et al., 2020 & Kumari et al., 2020). So, this study aimed to evaluate the effect of digital-based educational intervention on knowledge, misconceptions, and preventive practices of COVID-19 among Damanhour university students.

#### Research hypothesis

- Damanhour University students who receive the digital-based educational intervention will exhibit higher COVID-19 related knowledge, and preventive practices than those who are not.
- Damanhour University students who receive the digital-based educational intervention will exhibit lower COVID-19 related misconception than those who are not.

#### Materials and Methods

##### Research design:

A randomized controlled educational trial (pre- post-test control group) design was embraced.

##### Setting:

The study was held in four literature faculties in Damanhour

University, namely, Commerce, Education, Arts, and Early childhood faculty.

##### Subjects:

Four hundred university students from the previous setting were selected, fulfilling the following **inclusion criteria**:

- Had a smart phone and internet connection.
- Had no chronic diseases or disability.
- Not previously attend any educational sessions about COVID-19
- Accepted to be enrolled in the study.

**Sampling technique:** By using Multi-stage sampling technique, the following steps were conducted:

§ Four literature faculties (that are not studying health topics in their curriculum) were selected by lottery of random sampling technique out of six faculties.

§ Using equal allocation, a total number of 100 students were randomly chosen from each faculty and every academic grade (25 students).

§ Students were randomly allocated and selected from the list; every odd number was assigned to the intervention group (n= 200 students), and every even number was assigned to the control group (n= 200 students).

##### Sample size

The EPI info-7-software was utilized to estimate the total sample size based on students' average number in the selected faculties in the academic year 2019/2020 (37.543), 50% expected frequency, 5% acceptable error and 95%

confidence limit. Thus, the minimum required sample size was 381. It was upgraded to 400 to compensate for possible non-response.

#### **Tools for data collection:**

The researchers designed an online self-administered structured questionnaire after going through the related current literature. This questionnaire was alienated into three tools.

#### **Tool (I): Students' Knowledge and Misconception toward COVID-19**

This tool had three sections, as follows:

**Section 1: Socio-demographic characteristics:** age, gender, marital status, faculty, residence, monthly income, and previous contact with a case of COVID-19.

**Section 2: Students' knowledge about COVID-19 (WHO Corona virus pandemic, 2020 & WHO Myth busters, 2020).**

It enclosed 15 items relating to 6 categories of COVID-19 knowledge, including the disease's epidemiology, signs and symptoms, vaccination, treatment, vulnerable group, and preventive behaviors. A score of (1) was given to Yes, a score of (0) for No/Not Sure. The maximum score was ranged from 0-15 points, and the total knowledge score was regarded as:

- Poor < 50% (< 7.5)
- Fair 50% < 75% (7.5 < 11.25)
- Good  $\geq$  75% ( $\geq$  11.25)

An additional question (not included in the total score) was added asked about sources of information about COVID-19.

#### **Section 3: Students' misconceptions toward COVID-19**

It had 17 items based on "WHO myth-busters 2020" about the COVID-19 misconceptions. Reuse of masks, wearing elastic gloves, the role of shoes in virus transmission, and protection by multiple methods as sun exposure, smoking, cocaine, daily garlic intake, sesame oil, weed cigarettes, antibiotics, wash the nose with saline solution, ultraviolet sterilization lamps, hand dryers in public toilets, alcoholic beverages, spray the body with chlorine or alcohol, gases emitted from fireworks and intake of oseltamivir (**WHO Myth busters, 2020 & WHO 12 Myths of Covid-19, 2020**). A score of (1) was given to the yes answer, a score of (0) for no/not sure answer. The maximum score was ranged from 0-17 points, and the total knowledge score was categorized as:

- > 50% (> 8.5) = High misconception (High level of life-threatening)
- $\leq$  50% ( $\leq$  8.5) = Low misconception (Good understanding of the nature of disease)

**Tool II: Students' preventive practices toward COVID-19 (WHO, 2020, WHO, 2020 & WHO, 2020).**

It included 16 items to evaluate five categories of participants' preventive practices regarding COVID-19 as hand hygiene, respiratory etiquette, social distancing, public transportation avoidance, and healthy lifestyles. A three-point Likert scaled item was utilized ranged from always (2), sometimes (1) to rare (0). The total score was calculated and ranged between (0-32) and categorized at three levels:

- Poor < 50% (< 16)
- Fair 50 % -75% (16 to 24)
- Good > 75% (> 24)

### **Tool (III): Satisfaction scale with the interactive digital-based COVID-19 educational intervention**

The researchers created this scale to measure participants' satisfaction with the educational intervention from several dimensions: clarity of the objectives, content, knowledge presentation methods, educational media used, and usefulness of the program. This tool was included ten items; each item was rated on a five-point Likert scale; strongly disagree (1), disagree (2), neutral (3), agree (4) to strongly agree (5). Therefore, the total scale scores ranged from 1 to 50 and were categorized into three levels: -.

- $\leq 50\%$  ( $\leq 25$ ) = Dissatisfied.
- $51\% < 75\%$  ( $25 < 37.5$ ) = Neutral.
- $\geq 75\%$  ( $\geq 37.5$ ) = Satisfied.

### **Permission**

- An official letter from the Dean of Nursing Faculty was directed to the department of education and students' affairs at Damanhour University to inform them about the study aims and to take their permission to conduct the study in the selected faculties.

- Official letters from the Faculty of Nursing were directed to the deans of selected faculties to facilitate the study's implementation.

### **Tools validity and reliability**

- Face and content validity of the questionnaire was examined by a group of (5) experts in the field of community health nursing, and their responses revealed that the tool was valid.

The Cronbach's alpha coefficient test tested-Tools' reliability. The results were 0.78, 0.882, and 0.911, respectively, which indicated an accepted reliability of the tools.

### **Pilot study**

- It was carried out on 10% of the sample (40 students) out of the sample to assure the clarity, applicability, and comprehension of the study tools, estimate the average time needed to collect the required data, and identify obstacles that might be encountered during data collection. Accordingly, the necessary modifications were done.

**Program development:** it was done through the following phases:

#### **a. Assessment phase:**

The questionnaire was sent to be completed as a pre-test (tool I and II) by all intervention and control students in April 2020. They were told with the aim and the content of the study. For following the students up during three months of intervention, their mail address and telephone number were gathered to manage any encountered problems during program implementation.

#### **b. Planning Phase:**

The researchers created the program for the intervention group. After a thorough review of the recent literature and needs assessment of the students, the program content was settled, according to the following steps:

- **Setting general program objectives:** - provide the students with evidence-based health information about COVID-19, which can promote their knowledge and preventive practices through

declining the raised COVID-19 misconceptions.

- **Deciding on specific objectives:** at the end of the program, students could: recognize the concept of COVID-19 and the characteristic signs and symptoms of the disease, specify the modes of transmission, risk behaviors, and high-risk group, identify COVID-19 diagnostic measures and complications, and describe the preventive practices and control measures.

- **Determining the content:** it was designed based on the current literature and the assessment phase findings. It was divided into 12 subjects; anatomy of the respiratory tract, general knowledge about COVID-19, mode of transmission, factors contribute to infection, signs and symptoms, laboratory investigations, misconceptions related to COVID-19, treatment, methods of isolation, and preventive practices.

- **Designing the presentation methods:** numerous interactive digital-based methods were employed as Zoom meetings, Electronic-Mail, WhatsApp. The content was presented using text beside static and animated pictures, videos, and PowerPoint presentations. The researchers also tribute a WhatsApp group for the intervention group to smooth the daily communication using written or audio messages and to send the zoom meeting link on the predetermined date that fit the whole group. Besides, the link of the pre-and post-test was sent using the Survey Monkey application.

### c. Implementation phase:

- The educational intervention was implemented from May to June 2020. A weekly meeting was held on zoom with the intervention group. The program's intended content was also uploaded to the students through their e-mails and WhatsApp application.

- Daily brief health messages were delivered to the intervention group through the WhatsApp application.

The researchers ascribed to interactive learning principles through being permanently accessible (24 - hours per day all over the week) to answer students' questions.

### d. Evaluation phase:

- Evaluation for the intervention group was conducted twice, after one-month (in July) and three-months (in October) post-program implementation, by sending electronic post-test e-mail using tools I and II.

- Satisfaction with the program was evaluated using tool (III) after the intervention phase.

- Post-test was done for the control group simultaneously with the intervention group through communicating them at the selected appropriate app using the same tools.

**Statistical analysis:** Data were analyzed using the statistical package for social sciences (SPSS version 26) software. The level of significance selected for this study was  $\leq 0.05$ . The following statistical measures were used:

- **Descriptive:** frequencies, percentages, Arithmetic Mean, and Standard Deviation were applied to depict

the studied sample's characteristics and main variables.

• **Analytical:** independent sample t-test was employed to show the mean change's significance before and after the educational intervention. Pearson correlation coefficient was utilized to appraise the correlation between two proportions.

### **Ethical considerations:**

Informed oral consent was attained from each student after explaining the study aim. Their privacy and withdrawal freedom from the study at any time were realized preceding the start of the study. Privacy and confidentiality were maintained during the process of data collection. During communication with the intervention group, the privacy was convinced on WhatsApp by directing them to use the researchers' private page or e-mails to ask any personal questions. After the end of the program, the designed digital content was delivered for the control group via their e-mails.

### **Results**

**Table (1)** illustrates the absence of statistically significant differences between the intervention and control groups regarding all their socio-demographic characteristics and information sources. The mean age among the intervention group ( $22.03 \pm 1.47$ ) and the control group ( $22.86 \pm 1.48$ ). Most of both the intervention (94.5%) and the control (92.5%) groups were single and rural residence (63.5%, 61.0%, respectively). The highest percentage of both the intervention (36.5%) and the control (34.5%) groups had enough monthly income for basic and emergency needs, with the main source of information about COVID-19 was the

social media platforms (62.5%, 57.0%, respectively).

**Figure (1)** depicts that most of both the intervention and control groups have no previous contact with a case of COVID-19 (98.0%, 97.0% respectively) with no statistically significant difference between both groups ( $X^2 = 0.410$ ,  $P = 0.522$ ).

**Table (2)** portrays that most (82.5%) of the intervention group initially had poor total COVID-19 knowledge level. In comparison, most of them, after one month (90.0%) and three months (87.5%) of the educational intervention, moved to a good level. On the other hand, most of the control group remained at a poor level of the total COVID-19 knowledge initially (81.0%), after one month (80.5%), and three months (80.0%) of the program. Most (95.0%) of the intervention group had a high total COVID-19 misconception score initially, while after the educational intervention by 1 and 3 months, most of them had low COVID-19 misconception level (98.0%, 98.5% respectively). In converse, a high COVID-19 misconception level was found among the control group initially and after 1 and 3 months of the educational intervention (93.0%, 92.0%, and 91.5%, respectively). As regards the total COVID-19 preventive practices score, most of the intervention group initially had a poor level (80.0%) while a good level was reached among most of them after one (82.5%) and three months (82.5%). However, the control group showed poor total COVID-19 preventive practices score initially, and after one and three months (78.5%, 77.5%, 76.5%, respectively).

**Table (3)** reveals that the mean score of the total COVID-19 knowledge before the educational intervention had no statistically significant difference between

both the intervention and control groups ( $t= 1.265$ ,  $P=0.896$ ); however, a statistically significant mean difference was seen after one month ( $t= 38.573$ ,  $P=0.000$ ) and three months ( $t= 37.548$ ,  $P=0.000$ ) of the educational intervention. The mean score of the total COVID-19 misconception before the educational intervention showed no statistically significant difference between the intervention and control groups ( $t= 0.870$ ,  $P=0.807$ ). In contrast, a highly statistically significant mean difference appeared after one month ( $t= 28.038$ ,  $P=0.000$ ) and three months ( $t= 27.853$ ,  $P=0.000$ ) of the educational intervention. Finally, the mean score of the total COVID-19 preventive practices before the educational intervention revealed no statistically significant difference between both the intervention and control groups ( $t= 0.431$ ,  $P=0.666$ ); however, a statistically significant mean difference was observed after one ( $t= 44.433$ ,  $P=0.000$ ) and three months ( $t=$

$42.369$ ,  $P=0.000$ ) of the educational intervention.

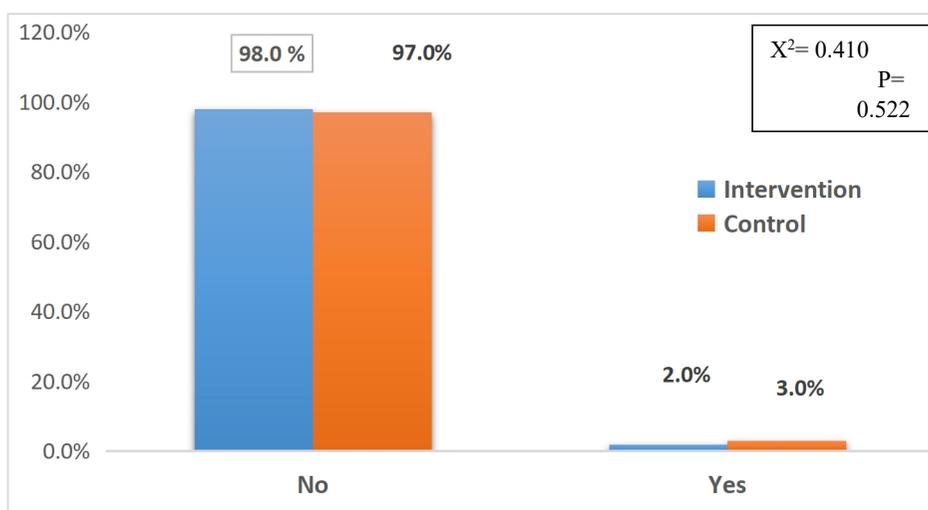
**Table (4)** shows that, before implementing the educational intervention, the total COVID-19 preventive practices of the intervention group had a statistically significant positive correlation with the total COVID-19 knowledge ( $r=0.768$ ,  $P=0.000$ ). Simultaneously, it was negatively correlated with the total COVID-19 misconception score ( $r= -0.541$ ,  $P=0.003$ ).

**Table (5)** illustrates that 75.0% of the intervention group was highly satisfied with the overall COVID-19 digital-based educational intervention. The highest percent of the intervention group was strongly agreed with the program's usefulness (65.0%), program content (55.0%), knowledge presentation methods (50.0%), and clarity of program objectives (50.0%) and the used educational media (45.0%).

Table (1) Distribution of the studied students according to their socio-demographic data and sources of information about COVID-19

Sociodemographic data	Intervention Group (N=200)		Control Group (N=200)		Significance
	No.	%	No.	%	
<b>Age (years)</b>					
Mean ± SD	22.03 ± 1.47		22.86 ± 1.48		t= 0.508 P= 0.612
<b>Gender</b>					
- Male	100	50.0	100	50.0	X <sup>2</sup> = 0.0 P= 1.0
- Female	100	50.0	100	50.0	
<b>Marital status</b>					
- Single	189	94.5	185	92.5	X <sup>2</sup> = 0.658 P= 0.417
- Married	11	5.5	15	7.5	
<b>Faculty</b>					
- Arts	50	25.0	50	25.0	X <sup>2</sup> = 0.0 P=1.0
- Early childhood	50	25.0	50	25.0	
- Commerce	50	25.0	50	25.0	
- Education	50	25.0	50	25.0	
<b>Place of Residence</b>					
- Rural	127	63.5	122	61.0	X <sup>2</sup> = 0.266 P= 0.606
- Urban	73	36.5	78	39.0	
<b>Monthly income</b>					
- Not enough and loan	45	22.5	40	20.0	X <sup>2</sup> = 0.877 P= 0.831
- Enough for basic needs only	57	28.5	63	31.5	
- Enough for basic and emergency needs	73	36.5	69	34.5	
- Enough and saving	25	12.5	28	14.0	
<b>#Sources of information about COVID-19</b>					
- Social media platforms	125	62.5	114	57.0	X <sup>2</sup> = 0.523 P= 0.770
- Mass media	59	29.5	60	30.0	
- Health experts and organizations	45	22.5	47	23.5	

X<sup>2</sup> Chi square test\*statistically significant at  $\leq 0.05$  #item is not mutually exclusive



**Figure (1)** Distribution of the studied students according to previous contact with a case of COVID-19

**Table (2)** Distribution of the intervention and control group according to their total knowledge, misconception, and preventive practices regarding COVID-19

Items	Before the intervention		educational		1 month after the educational intervention		3 months after the educational intervention					
	Intervention group (n=200)		Control group (n=200)		Intervention group (n=200)		Control group (n=200)		Intervention group (n=200)		Control group (n=200)	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
<b>Total COVID-19 knowledge</b>												
- Poor	165	82.5	162	81.0	0	0.0	161	80.5	0	0.0	160	80.0
- Fair	35	17.5	38	9.0	20	10.0	39	18.5	25	12.5	40	20.0
- Good	0	0.0	0	0.0	180	90.0	0	0.0	175	87.5	0	0.0
<b>Total COVID-19 misconception</b>												
- High	190	95.0	186	93.0	4	2.0	184	92.0	3	1.5	183	91.5
- Low	10	5.0	14	7.0	196	98.0	16	8.0	197	98.5	17	8.2
<b>Total COVID-19 preventive practices</b>												
- Poor	160	80.0	157	78.5	4	2.0	155	77.5	3	1.5	153	76.5
- Fair	40	20.0	42	21.0	31	15.5	40	20.0	32	16.0	42	21.0
- Good	0	0.0	1	0.5	165	82.5	5	2.5	165	82.5	5	2.5

**Table (3) Mean difference between the intervention and control group according to their total knowledge score, misconception, and preventive practices for COVID-19**

Variables	Max im-um allo wed score	Before the educational intervention			1 month after the educational intervention			3 months after the educational intervention		
		Intervention group (n=200)	Control group (n=200)	Sign. test	Intervention group (n=200)	Control group (n=200)	Test of Sign.	Intervention group (n=200)	Control group (n=200)	Sign. Test
		Mean $\pm$ SD	Mean $\pm$ SD		Mean $\pm$ SD	Mean $\pm$ SD		Mean $\pm$ SD	Mean $\pm$ SD	
Total COVID-19 knowledge score	14	6.31 $\pm$ 1.275	6.49 $\pm$ 1.556	t=1.265 P=0.896	13.99 $\pm$ 2.685	5.93 $\pm$ 1.234	t=38.573 P=0.00*	13.81 $\pm$ 2.534	6.23 $\pm$ 1.315	t=37.548 P=0.00*
Total COVID-19 Misconception Score	17	13.87 $\pm$ 3.143	14.11 $\pm$ 2.314	t=0.870 P=0.807	5.93 $\pm$ 1.958	13.75 $\pm$ 3.424	t=28.038 P=0.00*	5.26 $\pm$ 1.862	13.49 $\pm$ 3.741	t=27.853 P=0.00*
Total COVID-19 preventive practices score	32	10.07 $\pm$ 1.162	10.15 $\pm$ 2.351	t=0.431 P=0.666	30.21 $\pm$ 5.353	10.85 $\pm$ 3.052	t=44.433 P=0.00*	29.56 $\pm$ 5.345	11.12 $\pm$ 3.052	t=42.369 P=0.00*

t: independent sample t test

\* Statistically significant at  $\leq 0.05$ **Table (4) Correlation between the intervention group's total scores of COVID-19 knowledge, misconception, and preventive practices before the educational intervention**

Items	Total COVID-19 preventive practices (pre-program)	
	r	P
- Total COVID-19 knowledge score	0.768	0.000*
- Total COVID-19 misconception score	-0.541	0.003*

r: Pearson correlation coefficient test

\* Statistically significant at  $\leq 0.05$

**Table (5) Distribution of the intervention group according to their satisfaction with the COVID-19 digital-based educational intervention program**

Satisfaction with the COVID-19 digital-based educational intervention program	Intervention group (n=200)					
	Neutral		Agree		Strongly agree	
	No.	%	No.	%	No.	%
- Clarity of the objectives	9	4.5	91	45.5	100	50.0
- Program content	8	4.0	82	41.0	110	55.0
- Knowledgepresentation methods	6	3.0	94	47.0	100	50.0
- Educational media used	11	5.5	99	49.5	90	45.0
- Usefulness of the program	5	2.5	65	32.5	130	65.0
Total satisfaction score	<b>Dissatisfied</b>		<b>Moderately satisfied</b>		<b>Highly satisfied</b>	
	No.	%	No.	%	No.	%
	0	0.0	50	25.0	150	75.0

## Discussion

The novel COVID-19 pandemic is an enormous public health catastrophe coupled with huge misconceptions and inappropriate knowledge and practices. These necessitate the urgent need to increase public awareness with the evidence-based information and prevention measures to eliminate the myths around the disease and helping in its containment (WHO corona virus pandemic, 2020 & WHO 12 Myths of Covid, 2020).

Digital health deployment as a crucial modern technology for information and communication was endorsed by WHO in 2019. It can support customers' satisfaction by delivering need-matched digital health education, which can also support the health system in the face of the prominence flux of COVID-19 with the encircling misconceptions and rumors. Therefore, the researchers designed an interactive digital-based educational intervention to introduce the program content to be easily reached by the intervention group at any time (WHO guideline, 2020).

The current study's findings highlighted the efficacy of the digital educational intervention in improving the COVID-19 related knowledge and preventive practices and lowering the rate of associated misconceptions. Consequently, there is a pressing demand to go in line with the modern era of technological improvements and pondering individuals' preferences during educational program development to foster the prevention and control measures. There are rare educational intervention for COVID-19 that is concerned with enhancing COVID-19 related knowledge and preventive practices with no studies working to combat misconceptions surrounding this novel disease.

Three studies showed similar figures about the effectiveness of digital-based educational intervention during disease outbreaks. *First*, an intervention study by **Blanchard et al., (2020)** indicated that the interactive web-based educational program had a positive impact on participants' perceptions of the risk of infection and attitudes toward contagious diseases and vaccination. *Second*, a systematic review by **Solhi et al., (2017)** concluded that

combining health education with modern advances as e-learning and web-based intervention had a significant positive impact on the incidence and prevention of newly emerging diseases. *Third*, a meta-analytic study by **Wantland et al., (2004)** revealed a discernible improvement for individuals using web-based educational intervention than those who use non-web-based educational methods in achieving better knowledge and behavioral change.

It is worthiness to mention that, in the present study, before the implementation of the educational intervention, most of the studied students (intervention and control groups) had a high level of COVID-19 misconceptions with poor knowledge and preventive practices. These can be explained by the ambiguous nature of the Coronavirus and its changing clinical picture and the prolonged duration of the pandemic that can cause many people to be careless to some extent about following the appropriate preventive behaviors. All the studied students also were from literature faculties and did not attend previous educational sessions about COVID-19. Moreover, most of the intervention (62.5.0%) and control (57.0%) groups utilized social media as a main source of information about COVID-19. These highlight that social media can be a fertile area for the dissemination of rumors about COVID-19. Two recent Egyptian studies proved the same idea by **Abdelhafiz et al., (2020)**, **El-Gilany et al. , (2020)**, and a Chinese study by **Zhou et al., (2020)**. The latter also highlighted the need for creating social media-based campaigns by concerned public health authorities to lessen the dissemination of falsifying information about COVID-19. In response, WHO created a specialized website for combating these rising myths about COVID-19 known as "Mythbusters." (**WHO, 2020**).

Novel evidence showed that despite the rising awareness about the COVID-19 pandemic associated with social media propaganda, greater misconceptions about the disease and its prevention are prevalent. Misconceptions can be considered erroneous information that has been trending in the society even faster than the pandemic itself, leading to improper preventive behaviors (**Dutta et al., 2020**). Two Indian studies proved a similar figure by **Singh et al., (2020)** and **Gohel et al., (2020)**, which found a proper level of general knowledge about COVID-19 but with several misconceptions about its symptoms, transmission, prevention, and treatment with lower risk perception of infection. A Nigerian study by **Izekor et al., (2020)** also highlighted a high level of myths and misconceptions about COVID-19 that interfere with the country's mitigation activities for the epidemic.

In converse, **Zhou et al., (2020)** indicated a high level of COVID-19 awareness among Chinese residents. The authors attributed this to their participants' higher educational level and the use of scientific health experts as a common source of information by most of them. **Salman et al., (2020)** reported that most of the studied Pakistani university students had good knowledge and attitudes toward COVID-19 but had unsatisfactory preventive practices. These can be attributed to the enrollment of most of them in health colleges.

The current study confirmed the significance of the interactive digital-based educational intervention on improving COVID-19 knowledge and preventive practices. It illustrated that after implementing the educational intervention, most of the intervention group significantly improved from poor to good level after one and three months. A significant positive mean change in the

total score of COVID-19 knowledge and preventive practices was observed among the intervention group than the control group after the one-month educational intervention and maintained at follow up assessment after three months. These can be attributed to the people's jealousy and interest to gain more knowledge about the novel Corona virus and associated COVID-19 that is startling the whole world to protect themselves against the disease. Besides, the educational intervention's effective designation as evidenced by a higher satisfaction level among most (75.0%) of the intervention group.

Three recent studies showed similar improvements. First, an Egyptian study by **Ayed et al., (2020)** portrayed significant improvement in the total score of COVID-19 related attitude, knowledge, and preventive measures among the studied participants after implementation of the educational intervention. Second, **Kaim et al., (2020)** demonstrated that the digital educational intervention using brief video was simply implemented and effective in boosting personal resilience, perceived safety, and knowledge about COVID-19. Third, **Abbas et al., (2020)** proved that a web-based educational intervention module was influential in boosting the COVID-19 preventive practices among Pakistan's healthcare workers.

The current study also proved the significance of the interactive digital-based educational intervention on lowering the misconceptions surrounding the COVID-19. It was found that, after implementation of the educational intervention, most of the intervention group was significantly moved from high to low level of misconception after one and three months. A significant negative mean change in the total COVID-19 misconception score was observed among

the intervention group than the control group after one-month, which was sustained at follow-up assessment after three months. These can be attributed to the mistrusted sources of information about COVID-19 used by the intervention group, making this educational trial a fertile chance for them to rapidly change this misleading information through a scientific and validated educational trial. These, in turn, highlighted the eager need for educational intervention to support the public during this critical period of the pandemic.

Despite the ample evidence of the high deal of misconceptions surrounding the new emerging COVID-19, no evidence was found examining the effect of an educational intervention on the misconception level. However, several studies highlighted the need for such an educational trial to cut down such misconceptions. A Nigerian study by **Izekor et al., (2020)** revealed the importance of developing frequent and targeted awareness campaigns to combat the rising misconceptions about COVID-19 that can hinder the disease eradication strategies. An Indian study by **Narayana et al., (2020)** highlighted a perception gap of the underlying COVID-19 myths and facts. It recommended establishing educational programs and disseminating WHO myth busters by the media or social networks to resolve these misconceptions about COVID-19.

Knowledge can have a detrimental role in behavior change and health practices maintenance. The current study proved that COVID-19 preventive practices were positively correlated with knowledge level while negatively correlated with misconceptions. Incoherence, a Saudi study by **Al-Hanawi et al., (2020)** proved that for every one-point increase in COVID-19 knowledge score, there was an increase in

attitude (0.095) and preventive practices (0.16) scores. A Nigerian study by **Aminu ,(2020)** highlighted that the high burden of misconception about COVID-19 was one of the main hindering factors for the implementation of preventive practices. A Nigerian study by **Reuben et al., (2020)** showed a significant relationship between the COVID-19 knowledge and attitude towards preventive measures.

Being customers oriented is a primary principle of the quality improvement process. Thus, it is essential to assess the users' satisfaction with the delivered educational intervention. The present study illustrated that 75.0% of the intervention group was highly satisfied with the overall COVID-19 digital-based educational intervention. Three novel studies revealed a similar level of higher participants' satisfaction with the delivered digital-based educational intervention. *First*, a study from the USA by **Ramaswamy et al., (2020)** about the effectiveness of video visits during the COVID-19 pandemic. *Second*, an Egyptian study by **Sayed SH et al., (2020)** about the digital eye strain among computer users. *Third*, **Vosbergen et al., (2012)** for the health risk assessment among Netherlands' employees.

Toward the end, Egypt is one of the largest countries in the Arab region, Africa, and the Middle East. With more than 100 million citizens, Egypt is among the most densely inhabited countries in Africa. These could be accompanied by an unlimited risk of disease spread and mortality. So, it is necessary to keep the exposure possibility and the transmission rate as low as possible. Henceforward, global efforts are needed that take account of political efforts by the governments, together with personal correct knowledge and practices, which depend on the public awareness (**The**

**Central Agency for Public Mobilization and Statistics, 2020, Wang, 2020&Ministry of Health and Population, 2020).**

### **Conclusion:**

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Based on the existent study findings, the two-research hypotheses are accepted. The interactive digital-based educational intervention about COVID-19 effectively improves the university students' knowledge level, modifying their misconception, and refining their preventive practices. Besides, COVID-19 preventive practices were found to be positively correlated with knowledge and negatively correlated with misconceptions. Evidently, most of the study group was highly satisfied with the interactive digital-based COVID-19 educational intervention.

### **Recommendations:**

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- Enhance IEC's role (information-education and communication) in increasing awareness about COVID-19 to prevent transmission of infection.
- Conduct community mobilization campaigns to boost community awareness about COVID-19 infection, especially in the rural population.
- Establishing school-based health education programs about COVID-19 and incorporating it in school curricula.
- Expanding the development of COVID-19 hotlines to facilitate the disease control measures
- This study opens the door for other researchers to carry more interventional studies emphasizing COVID-19 misconception and preventive measures.

### Ethics approval and consent to participate

The Ethics Committee of Faculty of Nursing, Damanhour University approved this study [REC17.2020]

### Human and animal rights

No animals were used in this research. All human research procedures were followed under the ethical standards of the committee responsible for human experimentation.

### Consent for publication

Informed consent has been obtained from all the participants.

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### Conflict of interest

The authors declare no conflict of interest or otherwise.

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