MALAYSIAN JOURNAL OF LEARNING AND INSTRUCTION
https://e-journal.uum.edu.my/index.php/mjli

How to cite this article**:**
Singh, P., & Anthonysamy, L. (2023)**.** The dichotomization of objective and subjective outcome measures of academic performance in an online learning environment. *Malaysian Journal of Learning & Instruction*, *20*(1), 63-92. https://doi.org/10.32890/mjli2023.20.1.3

THE DICHOTOMIZATION OF OBJECTIVE AND SUBJECTIVE OUTCOME MEASURES OF ACADEMIC PERFORMANCE IN AN ONLINE LEARNING ENVIRONMENT

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Received: 17/3/2022 Revised: 22/9/2022 Accepted: 5/10/2022 Published: 10/1/2023

ABSTRACT

Purpose – Various recent studies are perplexed with the situation if subjective measures such as perceptions of learning reflect knowledge gains and whether they can be used as a surrogate for evidence of actual learning in an online learning environment. Due to a rising trend in current research studies interpreting perceptions of learning compared to actual learning as a measure of success, this study investigates the dichotomous measures of objective and subjective measures of academic performance in an online learning environment with selected predicted variables. This is followed by an investigation on the effect of online learning on students' academic performance prior to and during the Covid environment.

Methodology – This cross-sectional study employed a correlation design for the purpose of data collection among 382 university students. The dependent variable of study comprised objective measures of CGPA scores while the subjective measures was based on a composite score from perceived items in a questionnaire. The predictive independent variables included, i) satisfaction towards online learning, ii) online learning self-efficacy, iii) social interactive engagement in online learning, and iv) online learning environment.

Findings – The findings showed an extremely weak and non-significant relationship between actual academic performance (GPA) and perceived academic performance in an online learning environment. A statistically significant increase was notable in students' academic performance through GPA scores before and during Covid-19 academic semester and this increase was prevalent among low and intermediate achievers. Apart from environment, all other predictors were significant predictors of perceived academic performance. Engagement was a predictor for the subjective measure of CGPA scores.

Significance – Subjective measures data should not be considered as knowledge gain, and it should be used cautiously as a surrogate for evidence of actual learning. Educational research studies should be designed using more objective measures of learning rather than subjective measures in isolation as dependent variable. This should be seen as a caveat by policymakers in decision-making to practise consciousness in terms of judgemental modes employed in measurement and to exercise caution in collecting, analysing, and interpreting subjective data.

Keywords: Online learning, objective measures, subjective measures, perception, CGPA, perceived academic performance.

INTRODUCTION

Higher education institutions (HEIs) on a global scale are forced to weave into an entirely new dimension due to the Covid-19 pandemic, which is an unprecedented, unforeseen, and unfathomable phenomenon. This prompted a shift from the traditional classroom

learning environment to an online learning environment, which was not an ideal option for most institutions, faculty members and students. Nonetheless, this move has been perceived as the best decision based on the new normal for the academic year or possibly even longer. The question of module delivery within the domain of information technology and the effect on the landscape of online learning in HEIs in Malaysia is a matter of concern. Furthermore, whether the change could be classified as a "black swan" moment—for the approach of blended learning to form a vital pedagogical tool for HEIs nationwide, as envisioned in the Malaysia Education Blue Print 2013–2025, should be pondered. The outcome of participation in and acceptance of online learning courses and virtual classroom sessions as well as the preference for face-to-face sessions need to be discussed.

Research has shown that in comparison to face-to-face classroom sessions, online courses do not yield the same impact in terms of its effectiveness (Loeb, 2020; Bettinger & Loeb, 2017; Muda & Mohamed, 2016; Hajar, 2015; Norfadilah, 2010); nevertheless, currently, online learning is the better alternative to teaching and learning. The Covid-19 pandemic has led the education industry to shift to fully online classes, which is not a mere option, but rather mandatory for all modes (except for technical skills requirement) of instruction in higher education. Thus, the move requires the HEIs to have a robust disaster-plan system in overcoming constraints and challenges in conducting courses online. Furthermore, the academic performance of learners resulted by the shift from the traditional classroom learning environment to an online learning environment must be discussed and studied.

The term 'learning performance' or 'academic performance' or 'academic success' is extensively used in research studies and educational assessments among HEIs, particularly on informing practices in policy development. These encompass both subjective and objective measures. Learning performance from the context of subjective measures, is viewed from the lens of students, in terms of their satisfaction, engagement, self-efficacy and perceived academic performance. On the other hand, academic performance from the context of objective measures, focuses on employing objective measures, particularly through grade point average (GPA), examination results, and final course or academic grades. Subjective

measures employ the extensive use of self-report questionnaires in the study of various composite and complex constructs of learning performance as the main factor of study in education. However, these measures are likely to be biased, and could question the authenticity and validity of the construct measured. Given that students are poor judges of their own learning using these subjective measures, shouldn't educational research studies be designed using more objective measures of learning rather than using subjective measures in isolation as the dependent variable?

The purpose of this study is to investigate the dichotomization of objective and subjective measures of performance in an online learning environment with selected predicted variables. Firstly, this study will investigate the impact of this new dimension of online learning environment on learner's academic performance due to the Covid-19 pandemic. Secondly, this study aims to examine the relationship between objective and subjective measures of performance in this new online learning environment. Furthermore, this study amplifies the research and findings of studies on online learning, and the factors that impact the learning performance of students, and these include student satisfaction, self-efficacy, and engagement. The outcome of this study is intended to inform practice regarding the ability of students to retain information, and enhance the overall quality of learning in the online environment.

THEORETICAL ORIENTATION

In the context of a learning environment, each learner brings a unique set of experiences, beliefs and cognitive abilities that can be used to construct knowledge of learning. In the current context of online learning, learners are confronted with challenging situations. In this process, learners will construct new knowledge about the task that is viable in the current situation, but on previously constructed knowledge. This is in tandem with constructivist epistemology where knowledge does not exist independently of learners, but rather is constructed while learners attempt to make sense of their knowledge (von Glaserfeld, 1983). This theory serves as a theoretical basis for examining students' views of the online learning environment. It proposes that the "function of cognition is adaptive and serves the

organization of the online experiential world" (Wheatley, 1991). In other words, learners are constantly trying to 'make sense' of their world or the environment they live in. Since each learner lives through a different set of experiences, they interpret and understand ideas and objects differently. The learners will construct their own meaning for ideas based on what makes sense to them, based on what is familiar in their online learning environment.

The online learning methodology being used in the current learning environment is based on the usage of technology in providing an interactive environment for learners and instructors to engage for knowledge construction. Educational technologies are not merely concerned with the theory and practice of using technology for education but are also geared towards facilitating the learning process, through establishing an effective and conducive environment for learning (Jackson et al., 2010; Januszewski & Molenda, 2007). Thus, the role of the instructor modelled on constructivist theory is employed in developing the online classroom environment that facilitates interaction with learners for construction of viable knowledge.

LITERATURE REVIEW

Objective and Subjective Measures of Performance

The yardstick of a successful education system is commonly measured by students' tangible performance via objective measures based on teaching and learning activities from a set of pre-designed curriculum experienced from this education process (Moody, 2019; York et al., 2015; Bettinger et.al., 2015). The most common guide of tangible performances of objective measure is cumulative grade point average (CGPA), which is used for university entrance, scholarship eligibility, admission into college, and finding jobs upon graduation. Similarly, Moody (2019) factored in CGPA for financial aid and scholarships eligibility, program admission and graduation. This was further espoused by York et al. (2015), where they elucidated that the results obtained, specifically via the measure of CGPA as the most suitable and available mode of testing students' performance academically, which also assists in the determination of such performance among students. This tangible performance at tertiary level measured by

CGPA functions as a platform for students to display what they know as acquired via various modes of assessment such as tests, quizzes, presentations, and final examinations. First, academic institutions commonly take into consideration results in measuring academic achievement, and these encompass ranking students via their CGPA, and giving designations such as valedictorian and salutatorian for first or second class degree holders, scholarship recipients based on CGPA including graduate hiring by employees. Apart from the students, academic achievement as a yardstick of academic success is apparent on a wider scale to the universities as well.

On the other hand, the current trend in educational research also considers learning performance as a variable of study based on subjective measures. These subjective measures are usually utilised when the construct of measure cannot be observed directly and is often explicit (Lucker et al., 1981). They elaborated that these measurements are used when affective measures are the focus in instances where subjective opinion transpire. They provided an example in the measurement of physical beauty as the affective measurement of subjectivity (from objective beauty). Lucker et al. (1981, p. 57) elucidated further that "since there are no absolute standards of physical beauty, the truth by 'consensus method' has been used to obtain 'objective' categories of target attractiveness". Following this approach, there are limited objective domains to be assessed. Subjective measures are commonly used in the medicine field in measuring the level of pain of individuals. There are several obstacles when assessing pain, given that this is an experience imbued with complexity and subjectivity. As of now, there seems to be a lack of a proper mode in the quantification of the experience of individual pain. Thus, self-report measures of numerical scale from 0 to 10 is used as a subjective gauging measure of the consequence of pain, whereby a scale of 0 points to an absence of pain, a scale of 1 to 3 indicates minor pain, a scale of 4 to 7 indicates moderate pain, while a scale of 8 and above points to excessive pain.

Philosophical views are elucidated when there is no scientific precision involved in a measurement; thus, the issue of validity arises. Cole (1985, p. 98) stated that "Scientific objectivity is inevitably blurred by the biases built into human perception". Observations cannot be taken as a suitable mode of assessment. Webb et al. (1966, p. 142) concurred

that, "When the human observer is the recording agent, all the fallibilities of the organism operate to introduce extraneous variables into the data…. people are low-fidelity instruments". Chapanis (1959) also made this point, suggesting that human observation is a poor tool when it comes to the assessment of multidimensional phenomena. Therefore, there is a need to ascertain whether the subjective measure of perceived performance via self-report or questionnaire is considered as a valid tool of measurement especially in the context of learning.

These perceived learning terms such as 'learning performance or academic performance or academic successes are currently among the widely used variables of measurement in educational research. According to Soderstrom and Bjork (2015), it points to a robust difference in the attitude of students where their perception levels are concerned, as well as abilities that support the retention and transmission of knowledge in the long term, assessed by subjective measures. According to researchers (Li et al., 2018; Yang et al., 2016) this term is a way of quantifying affective variables, such as satisfaction, engagement, motivation, and attitude. There is consensus that seeking information on affective variables of study where subjective opinions transpire and differ from one another, via self-report or questionnaire can be considered as a valid tool of measurement. However, in the context of academic performance, the relevance to seek information on academic performance via self-report or questionnaire must be ascertained. Moreover, it is also pertinent to identify the significant relationship between learner's academic performance assessed via objective measure of CGPA and subjective measure of perceived performance.

Impact of Online Learning on Learner's Academic Performance

The Covid-19 pandemic has forced universities nationwide to explore, adjust and familiarise with the shift in learning processes to the online world; as involuntary as it may be, there is undoubtedly huge apprehension concerning the ability to ensure quality education. Various studies have indicated mixed results on the relationship between academic performance and online environment. Studies have shown that although students are able to access online learning, it is especially challenging for weaker students, and those least prepared for learning in this manner (Bettinger et al., 2015; Cavanaugh &

Jacquemin, 2015; Jessica et al., 2017). A study by Bettinger et al. (2015) revealed a downward spiral in students' online academic performance as opposed to the conventional face-to-face classroom environment. There are students who are worried and fearful that online courses could possibly affect their learning performance. Jessica et al. (2017) discovered that students taking online college algebra faced huge difficulties and were not able to graduate on time due to using online methodology to chart their academic progress. In a study by Cavanaugh and Jacquemin (2015), their findings indicated that online courses had an academically positive impact among high achievers but a negative impact among low achievers based on GPA scores.

In a recent report by Professor Jonathan Zimmerman (author of The Amateur Hour: A History of College Teaching in America) (as cited in Lederman, 2020), amid the pandemic influence on online education in higher education, he elucidated that:

> Online education … was barely noticed by our regular students, who get their education the old-fashioned way: in the classroom. Now, for the first time, they will not. They are going to be thrown into the same big pot as everyone else. An intervention designed to serve the masses is now going to be foisted on the (upper) classes.

He echoed the sentiments of Bettimger et al. (2015), Cavanaugh and Jacquemin, (2015) and Jessica et al. (2017) on the possible impact of online education for students who are not academically inclined and least prepared for it.

One of the main issues faced due to the deterioration of academic performance is the lack of interaction and engagement in an online classroom. According to Joosten et al. (2019), students who require more assistance or are struggling academically expect greater communication and interactivity from their instructor. Students face isolation as online learning can be a barrier to participation (Gillett-Swan, 2017). The greater their perception of instructor interactivity, the greater their perception of learning. Student engagement in online learning at tertiary level is becoming more of a concern nowadays following the change in technology-driven learning experiences.

On the other hand, Soesmanto and Bonner (2019) in his study in Australia in evaluating the comparative analysis of face-to-face mode and online mode found no significant difference in learning satisfaction and academic performance between the two modes. Similarly, another study conducted in Australia by Lorenzo-Alvarez et al. (2019) found similar academic outcomes between face-to-face learning and online teaching. Cavanaugh and Jacquemin (2015) also compared grade-based learning outcomes between online and face-to-face courses taught at Ohio University, using a large dataset of 5,000 courses taught by over 100 faculty members, whereby the study found no significant difference between these two modes of instruction. In a recent study by Said (2021) on college students' CGPA academic performance before and after the lockdown also found no statistically significant difference in students' CGPA grades. In addition, he elucidated further that the unplanned and rapid move to online distance learning at the time of the pandemic did not result in a poor learning experience as perceived.

These studies have revealed mixed results, thus the question to ponder on is whether this shift from the traditional classroom learning environment towards an online learning environment due to the completely unprecedented, unforeseen, and unfathomable phenomenon of the Covid-19 pandemic led to lower grades. Thus, it is vital for policies and regulations to be in place to regulate such matters, regarding educational organizations in general including instructors. What needs to be investigated is how these online environments can provide not just access, but better learning outcomes especially for those who need it most. Thus, the first part of this study examines the impact of the transition from face-to-face environment to an online learning environment on learners' academic performance as reflected in their CGPA.

Academic Performance with Predictive Factors for Effective Online Learning

Various studies have shown mixed results on the relationship between academic performance with critical predictive factors of online learning such as satisfaction, self-efficacy, social interactive engagement, and environment. Recent local studies (Lilian et al., 2021; Azzieatul & Lai, 2021; Karim et al., 2021; Zahir et al., 2018) have suggested a

positive relationship between academic achievement and online learning readiness. Most of these studies showed optimistic narratives of student readiness that had a positive impact on their performance, which coincidentally, was based on perceived academic performance.

The next dimension of interest relates to pedagogical engagement in online interactions and communication. This refers to the modes in which individuals conduct interactions with one another through the mechanism of computer networks, such as the internet. Findings from various studies have shown that 'timid and shy' students have the tendency of being more participative through such medium, as compared to the usual traditional classroom setting (Palloff & Pratt, 1999). This is foreseeable whereby an analogy can be drawn from real life, social situations too as it is often easier for individuals to interact with someone they do not know behind the screen, than to carry out a face-to-face conversation. This could, in some aspects, be seen as a positive outcome in the online learning world. In a study by Abramenka (2015) among undergraduates, it was found that most undergraduates identified interaction and collaboration as areas that were most challenging in online environments. As McVay (2001) stated, the online learning mechanism should be tailored towards the provision of modes allowing for engagements between students and their instructors, bringing the experience as close as possible to the traditional, classroom-based learning. Thus, instructors must understand their role in the online learning context to effectively achieve learning outcomes outlined. The occurrence of meaningful interactive engagement in the current online learning environment in relation to student performance, and the impact due to the current online learning environment on students must be identified and discussed.

Lastly, the final dimension of interest is online learning self-efficacy related to computer and internet usage. Bandura (1977) posited that self-efficacy is a learner's perceptual ability to deal with situations requiring appropriate action. It is important to stress that a combination of both computer and internet self-efficacy is required, and not just one over the other. For a successful online learning process to transpire, one must be proficient with the establishment, maintenance, and utility of the Internet, in addition to the know-how regarding basic computer skills (Eastin & LaRose, 2000). Thus, in combination,

it forms modes of assessments that are interrelated concerning the perception of individuals as they make use of technology in such a manner, and the ability of these individuals to use such technology, which is basically computer-based assessments.

As indicated earlier, all instructors, students, and personnel in HEIs in Malaysia are searching for the best mode of online learning as they are thrust into this unchartered territory of online learning due to the pandemic. Although many have reservations about this online mechanism, after more than a year of its implementation, the Covid-19 pandemic has left everyone with no choice but to take the bull by its horns and familiarize themselves with this useful tool, which could possibly pave the path for its accelerated trend in the new horizon.

OBJECTIVES OF STUDY

The purpose of this study is to investigate the dichotomization of objective and subjective measures of performance in an online learning environment with selected predicted variables of study. Specifically, the objectives are:

1. To investigate the effect of online learning on academic performance among college students.
2. To examine the relationship between objective and subjective measures of academic performance in an online learning environment among college students.
3. To determine the significant predictors of satisfaction towards online learning, online learning environment, online learning self-efficacy, and social interactive engagement in online learning for objective and subjective measures of academic performance among college students.

METHODOLOGY

Participants and Research Design

This study adopted a quantitative approach using a correlational design. A cross-sectional design using survey methodology was employed for

data collection. The total population of students selected for this study was approximately 30 000 students. According to the Krejcie and Morgan table (1970), using the fundamentals of confidence interval **(**also called margin of error) of 5 percent and confidence level of 95 percent, the sample requirement was approximately 380 students. Based on a stratified sampling technique, a total of 382 students from a public university in the Klang Valley participated in this study. The gender composition of the students comprised 39.0 percent (N=149) male and 61 percent (N= 233) female. These students were from the science field and non-science field with 37.2 percent (N=142) and 62.8 percent (N=240), respectively.

Instrumentation and Constructs

This study adapted questionnaires from Hung et al. (2010), Abramenka (2015) and Sun et al. (2008) accordingly to explore students' perceived views on online learning and teaching. The dependent variables of the study comprised objective and subjective measures of academic performance. The former was based on students' GPA grades (prior and during Covid-19 academic semester) and CGPA while the latter (perception of learning-academic performance) was measured using a ten-point scale based on a composite score from perceived items in the questionnaire.

The predictive independent constructs consisted of: i) satisfaction towards online learning, ii) online learning self-efficacy, iii) social interactive engagement in online learning, and iv) online learning environment. Due to the current Covid-19 situation, this survey was administered through an online survey mechanism (i.e., surveymonkey.com). The item responses for these constructs were rated using a ten-point Likert scale (from 1= very low to 10 = very high) for students to express their views.

The constructs of study for perceived academic performance, satisfaction, self-efficacy, engagement, and environment had a high internal reliability coefficient of 0.898, 0.820, 0.942, 0.907 and 0.869, respectively which indicated a credible level of reliability as an instrument of study. The content validity of the instrument was re-established by seeking the constructive views of three experts within the field. All their views were taken into consideration before the data collection process.

Research Procedure

The data collection for this study commenced after attaining approval from the university's ethics committee. A pilot study was conducted on 15 respondents that represented the population of the study. The outcome from the findings was taken into consideration, especially in the context of terminology and wording of the questionnaire, getting accustomed to the online data collection procedure and the time required for the completion of the questionnaire. The questionnaire containing the quantitative data was then administered via an online survey tool (i.e., see surveymonkey.com) and the data was kept in the Survey Monkey database.

Data Analysis

The data were analysed using both descriptive and inferential statistics. The first level of analysis detailed the usage mean scores (with SD) and frequencies together with t-test in investigating the impact of online learning instruction on objective performance. The second level of analysis detailed the bivariate correlation between the variables of study using Pearson *r* correlation. This was followed by multiple regression in examining the extent each independent variable construct (satisfaction, self-efficacy, engagement, and environment) influenced the dependent variables of the study.

RESULTS AND DISCUSSION

Impact of Covid-19 Online Instruction on Students' GPA Scores

Research Question: *What is the significant difference in students' GPA scores before and during Covid-19 online instruction?*

The findings in Table 1 shows an increase in GPA scores from 3.33 (SD=.38) during pre-Covid-19 semester to 3.39 (SD=.38) during Covid-19 semester. This increment was significant [t (286) = -3.282, p = .001] at the 0.05 level. This indicated an increase in students' academic performance in GPA scores before and during Covid-19 semester.

Table 1

GPA scores before and during Covid-19

	N	Mean	SD	t	df	p
Pre-Covid-19 Semester (GPA1)	*287	3.33	.38	-3.283	286	.001
During-Covid-19 Semester (GPA2)	*287	3.39				

Max score of 4.00

*95 Missing data either in GPA1 or GPA2

Research Question: *What is the significant difference in GPA scores before and during Covid-19 online instruction among:*

a) Very low achievers (≤ 2.74)*?* *b) Low achievers* (2.75 – 2.99)*?*

c) Intermediate achievers (3.00 – 3.49)*?d) High achievers* (≥ 3.50)*?*

The findings in Table 2 shows a significant increase in the mean scores among very low achievers [t(18)=-4.697, p<.05], low achievers [t(21)=-2.818, p=.010] and high achievers [t(159)-3.402, p=.001]) at the 0.05 level. However, there was a significant decline [t(85) = 3.477, p=.001] in GPA scores from 3.72 (SD=.13) to 3.64(SD=.20) at the 0.05 level among the high achievers group. Nonetheless, the findings indicated an increase in GPA scores across all levels of achievers except the high achievers.

Table 2

Paired Sample T-test Analysis during Pre-Covid Online Instruction by GPA level (N=287)

GPA Classification Pre-Covid	N	GPA (SD) Pre-Covid	GPA (SD) During-Covid	t	df	p
Very low (≤ 2.74)	19	2.36 (.18)	2.68 (.33)	-4.697	18	.000
Low (2.75 – 2.99)	22	2.93 (.06)	3.14 (.36)	-2.818	21	.010
High (3.00 – 3.49)	160	3.30 (.16)	3.38 (.32)	-3.402	159	.001
Very high (≥ 3.50)	86	3.72 (.13)	3.64 (.20)	3.477	85	.001

The findings in Table 1 and Table 2 contrasted with previous studies (Bettimger et al., 2015; Jessica et. al., 2016). The study by Bettinger et al. (2015) indicated a downward spiral among low achievers in

their performance online as opposed to the conventional classroom environment. Similarly, findings by Jessica et al. (2016), found that low achiever students faced great difficulty and were unable to graduate on time due to the use of online methodology to chart their academic progress. Nevertheless, recent findings related to the Covid-19 situational context of online teaching suggest an inflation of grades during this period. In a study by Karadag (2021), he found that the pandemic caused a marginal increase in grades in higher education in Turkey. Similarly, in another study, Sparks (2022) reported that students' grades ratcheted up in 2019 and the pace accelerated during the pandemic. This is a global phenomenon as similar grade inflation has been detected in universities in the UK, USA, and other parts of the world (Bloomberg, 2022; Strauss, 2021). The report from Strauss (2021) stipulated that "it is not fair to give grades that haven't been earned, and the people who end up being cheated are the students themselves." There are many reasons provided as the cause of the inflation, which include: instructors being more lenient, an easier grading system, and cheating. This is a neglected topic in higher education literature, and more research is needed to probe into these areas of concern.

The challenges and issues faced after transition from conventional classroom to online learning by both the high achievers and low achievers involved in the study need to be discussed. Currently, the following are the two perceived challenges faced by these students in the online learning environment.

Perceived Stress Level and Engagement in Online Classroom by CGPA level

This section analysed the extent to which students experience stress after transition from conventional classroom to online learning based on CGPA level. A cross tab descriptive analysis was computed from a five-point scale of 'no stress' (1) to 'stress caused serious issues' (5). The descriptive analysis of stress was measured from a composite analysis from 'Enough stress to cause some issues' (4) and 'Stress caused serious issues' (5). To be noted that the question on stress was posed as a single item entity and not as a construct of study. The findings showed that 45.2 percent (N=152) of the sample experienced stress issues after transition from conventional classroom to online learning (total of column 4 and 5). From the analysis, 49.8 percent

were among the very high achievers, followed by intermediate and high achievers with 40.7 percent and 36.4 percent, respectively.

The cross tab descriptive analysis with their current CGPA level indicated that the perceived level of engagement in online learning environment was the highest for the low (2.51–2.74) and very low achievers (≤2.50) with mean scores of 6.88 (SD=1.62) and 6.80 (SD=1.69), respectively (from a maximum score of 10). On the other hand, the very high (3.25–4.00) and high achievers (3.00–3.24) perceived a moderately low level of engagement in the online learning environment with mean scores of 5.50 (SD=1.66) and 5.67 (SD=1.74), respectively.

Both the findings suggest that stress and classroom engagement were issues that had impacted the learners' GPA scores. The outcome of this study contradicted previous studies (Bettimger et. al., 2015; Jessica et. al., 2016) as in this study, the high achievers faced greater challenges and were least prepared for online learning. The authors perceived that, firstly, this could be due to the characteristics of high achievers who are inclined to drive themselves to the wall with the expectation to be 'perfect' and always deliver their best, compounded with uncharted obstacles in the online environment such as connectivity, technical glitches, computer illiteracy, disruptions at home which to a large extent might have affected their academic performance. If they push themselves too hard, stress has the potential to overwhelm and become difficult to cope (Gallagher, 2021). This was supported by Morris (2020) in her study conducted on 450 college students where more than two fifths of them faced 'stress, anxiety, and loneliness', which they cited as their greatest obstacles during the fall semester that inadvertently impacted them academically. The high achievers in this study might have these characteristics as indicated by Gallagher (2021) and Morris (2020) which could have impacted them academically.

Secondly, lack of engagement and interaction may have also contributed to the decline in academic grades among the high achievers. The literature has supported the idea that most of the time in a face-to-face classroom environment, high achievers usually sit in front of the class, and monopolise most of the interaction with instructors. Given the online classes with uncharted obstacles (as discussed), further compounded by a halt in freedom of interaction and communication with the rest of their classmates, this could have aggravated and amplified their loneliness and gave rise to a far from

ideal platform for interaction and learning to take place successfully. Inadvertently, this could have resulted in a decline in their GPA grades. This theoretical underpinning was corroborated by previous studies (Abramenka, 2015; Banna et al., 2015; Britt, 2015), which stress the importance of interaction and engagement among students in the process of online learning, thereby proving the necessary effort required for cognitive development, and the ability for knowledge construction, subsequently leading to greater levels of academic success.

The following analysis details the bivariate correlations of the variables involved in the study.

Bivariate Correlational Analysis

Research Question: *What is the significant relationship between actual academic performance (GPA) and perceived academic performance in an online learning environment among college students?*

Table 3 shows the students' perceived academic performance in online learning during Covid-19 academic semester. The highest mean scores of 6.30 (SD=2.38) and 6.23 (SD=2.25) were obtained for the item, '*My individual work assignment is better after I learned using online platform'* and *'I have a better exam pass rate when I use online platform as compared to face-to-face resources'*. On the other hand, the lowest score of 5.68 (SD=2.25) was for the item, '*My group work assignment is better after I learned using online platform'*. The overall mean score of the students' perceived academic performance in online learning was 6.00 (SD=1.99). This showed that these students had a moderately high perceived academic performance attainment for online learning during the Covid learning environment.

Table 3

Perceived Academic Performance for Online Learning

Perceived Academic Performance	N	Mean	SD
My grades are better when I use online platform as compared to face-to- face.	382	6.03	2.39
I have a better exam pass rate when I use online platform as compared to face-to-face resources.	382	6.23	2.25

(continued)

Perceived Academic Performance	N	Mean	SD
My individual work assignment is better after I learned using online platform.	382	6.30	2.38
My group work assignment is better after I learned using online platform.	382	5.74	2.49
My academic performance has improved since using online platform.	382	5.68	2.25
Overall Perceived Academic Performance	382	6.00	1.99

Scale 1 to 10

The findings in Table 4 shows an extremely weak and non-significant relationship (r=.056, p=.311) between actual academic performance (GPA) and perceived academic performance in an online learning environment among university students.

Table 4

Bivariate Correlations between Perceived Academic Performance and GPA Performance

		GPA Performance
Perceived Academic Performance	Pearson Correlation	.056
	Sig. (2-tailed)	.311
	N	331

The findings on the bivariate correlations corroborated findings by Deslauriers et al. (2019) on Harvard University undergraduates whereby objective performance on a paper and pencil test was not congruent with self-reports of what they had learnt. A similar finding by Pennycook et al. (2017) elucidated that college students tend to overestimate their performance on a self-report measure of metacognitive disposition as compared to the objective measure by the administration of cognitive reflection test (CRT) which measures analytical reasoning.

There is tendency among individuals to overestimate their cognitive knowledge than actual knowledge that they possess. Based on observations by Kruger and Dunning (1999), individuals who lack competency face problems in recognizing, and as a result, have a tendency of overrating their ability. Those who lack knowledge and

metacognition are unaware of such insufficiency in order to realize this biasness on a cognitive level. Hence, this phenomenon, which is also called *illusory superiority* (as coined by Kruger & Dunning, 1999), points to individuals' tendencies to overrate their plus side in terms of capabilities and qualities, and undermine their downside relative to others. In the context of subjective measure evaluation on learning performance, the reason for which there tends to be an overestimation of judgement among students has yet to be adequately evaluated.

The underpinning theory was best described by Deslauriers et al. (2019, p. 192) whereby "these results suggest that when students experience the increased cognitive effort associated with active learning, they initially take that effort to signify poorer learning. (… and that may have a negative effect on their motivation, engagement, and ability to self-regulate their own learning". Thus, the implication of this miscalculated assumption, whereby a student shows overconfidence, by overestimating his abilities by leaps and bounds, could result in a premature termination of his course of study and following so, halting himself from striving towards competency (Dunlosky & Rawson, 2012). The consequence of this is when an educational institution misinterprets the findings of a study(s) based on subjective measures, it could erroneously implement superficial strategies for policy enhancement and development.

Regression Analysis for Academic Performance

This final section examines the extent of how each independent variable construct (environment, satisfaction, self-efficacy, engagement) influences the dependent variables of this research namely GPA scores and perceived academic performance (PAP).

Research Question:

What is the significant impact of self-efficacy, environment, engagement, and satisfaction on learners' perceived academic performance (PAP)?

H_1: There is a significant impact of self-efficacy on learners' PAP
H_2: There is a significant impact of environment on learners' PAP
H_3: There is a significant impact of engagement on learners' PAP
H_4: There is a significant impact of satisfaction on learners' PAP

Table 5

Regression Analysis on Perceived Academic Performance

Hypothesis	Regression weights	B	T	p-value	Hypothesis supported
H_1	SE ⟶ PAP	.207	.3.627	.000	Yes
H_2	ENV ⟶ PAP	-.013	-.226	.821	No
H_3	ENG ⟶ PAP	.341	5.084	.000	Yes
H_4	SAT ⟶ PAP	.330	5.438	.000	Yes
R^2	.486				
F(4, 377)	89.017			< .001	Yes

Note: *p< 0.001, SE: Self-efficacy, ENV: Environment, ENG: Engagement, SAT: Satisfaction, PAP: Perceived Academic Performance

A multiple linear regression was computed to predict PAP based on their satisfaction (SAT), environment (ENV), self-efficacy (SE) and engagement (ENG). A significant regression equation was found [$F(4,377) = 89.017$, $p < .001$), with an $R^2 = .486$, which explained that the model indicated a moderately high 48.6 percent of the variance in PAP. Apart from environment, all the other predictors were significant predictors of PAP. The results also indicated that engagement (ENG) followed by satisfaction (SAT) in online learning were the most important predictors of student perceived academic performance. The significant predictors of engagement and satisfaction are supported by previous literature based on subjective measures (Banna et al., 2015; Britt, 2015; Meyer, 2014). They generally stress on the pertinence of interaction and engagement among students in the online learning process. Thus, this is taken to showcase the significant effort needed for their involvement in the cognitive sphere, as well as their ability in constructing their own knowledge, which in turn would lead to greater results in terms of student achievement. Sustained interactions between students and instructors (and fellow students) are the cornerstone of effective teaching whether face-to-face or online. Several forms of meaningful engagements that enhance cognitive development, eventually creating knowledge, include assigning group sessions, having board forums in order to obtain feedback, garnering suggestions, or even appraisals from classmates. This set of student-instructor-student online engagement has the inclination of inculcating depth in terms of understanding and bringing about rather fascinating practical repercussions of such course concepts and

theories, thereby leading to better academic performance. This was also echoed by other researchers (Dixson, 2010; King, 2014) who stipulated the importance of interaction. Recipients and providers of information in the online setting must work together for the purpose of bringing about better engagement online among students and to assist in the setting of their academic expectations.

Research Question:

What is the significant impact of self-efficacy, environment, engagement, and satisfaction on learners' GPA scores?

H_5: There is a significant impact of self-efficacy on learners' GPA scores.

H_6: There is a significant impact of environment on learners' GPA scores.

H_7: There is a significant impact of engagement on learners' GPA scores.

H_8: There is a significant impact of satisfaction on learners' GPA scores.

Table 6

Regression Analysis on CGPA Scores

Hypothesis	Regression Weights	B	t	p-value	Hypothesis Supported
H_5	SE ⟶ GPA	.019	.235	.815	No
H_6	ENV ⟶ GPA	-.140	-1.552	.122	No
H_7	ENG ⟶ GPA	.183	2.222	.027	Yes
H_8	SAT ⟶ GPA	-.081	-1.108	.269	No
R^2	.020				
F(4, 326)	1.659			.159	No

Note: *p< 0.05, SE: Self-Efficacy, ENG: Engagement, ENV: Environment, SAT: Satisfaction, GPA: Grade Point Average

The dependent variable (GPA) was regressed on predicting variables of self-efficacy, engagement, environment, and satisfaction. In general, the independent variables do not significantly predict GPA scores [F(4, 326)=1.659, p = 159] at the 0.05 level. However, from these four predictors, only environment was the significant predictor of GPA scores. Moreover, the R^2 = 0.020 indicated that the model showed an extremely low 2 percent of the variance in GPA scores.

These findings are in contrast with the literature (Dogan, 2015; Klassen, 2010; Michaelides, 2008; Bettinger et al., 2015; Jessica et al., 2017) suggesting a relationship between objective academic performance and variables dealing with critical predictive factors such as satisfaction, self-efficacy, social interaction, engagement, and environment. The authors believe that the output of this study concurs with the principle by Webb et al. (1966, p. 142): "When the human observer is the recording agent, all the fallibilities of the organism operate to introduce extraneous variables into the data. People are low-fidelity instruments." The contention here is that affective variables which are of a subjective nature do not provide the same judgement measurement for all. For example, individual A with a low cognitive level attained a score of 50 for his academic performance will perceive it differently from individual B with a relatively high cognitive ability who scored 75 in his academic performance. A will perceive it as high academic performance (e.g., from a scale of 1= 'very low' to 7 = 'very high') while B will perceive it as low academic performance (based on his cognitive ability), although he attained a much higher score than individual A. Thus, using a scale measurement from a questionnaire will not provide consistent judgement for different individuals with the same scores or different scores. This is probably what Kruger and Dunning (1999) meant by *illusory superiority*, where there is a tendency to exaggerate the plus side and capabilities of people, and to underrate the downside in terms of quality in relation to others and more.

CONCLUSION

One of the huge challenges that institutions of higher learning deal with currently due to the pandemic is to determine the quality and impact of its online teaching on students' academic performance based on its educational system. It is of utmost importance to take note of the components that impact performance as policies and effective pedagogical practices are implemented based on these findings.

The results of this study suggests that there is an extremely weak relationship between subjective measures and objective measures in relation to academic performance. For decades, subjective measures premised on questionnaires were utilized extensively in

the educational sphere by researchers and students to investigate composite constructs, which for the purpose of this study concerns academic performance or academic success. The intensity of the measured performance is questionable by virtue of the presence of potential bias in questionnaires as indicated in this study. Studies on perceptions of learning may not reflect knowledge gain, and perception data should be used cautiously as a surrogate for evidence of actual learning. Nonetheless, in no way does this automatically indicate that questionnaire measurements become redundant and counterproductive due to subjectivity. Instead, it signals a warning for the need to be emphatical and sensitive, especially to possible subjectivity, and to be particularly conscious of judgements concerning measurement, and to practice caution in terms of gathering, studying and deciphering subjective data.

Secondly, there was a statistically significant increase in students' academic performance in GPA scores before and during the Covid-19 academic semester, and this increase was prevalent among the low and intermediate achievers except the high achievers. The descriptive analysis provided evidence to support the notion that high achievers experience greater levels of stress compared to low achievers after the transition from conventional classroom to online learning. Based on these outcomes, more studies need to be done to examine students' performance over the next few semesters as this study was conducted using a cross-sectional analysis. This is because since this study was a one-time measurement of exposure and outcome of students' academic performance, it is difficult to derive any causal relationships from this cross-sectional analysis. Secondly, a recommendation to use qualitative methodology to further investigate the increase in students' academic performance between semesters and the reason why high achievers experience more stress than their counterparts, the low achievers.

Thirdly, this study investigated the predictive roles of the variables towards both perceived academic performance (PAP) and actual academic performance (GPA), where multiple regression was used for the analysis. Apart from environment, all the other predictors were significant predictors of perceived academic performance. On the other hand, only environment was a predictor for the objective measure of GPA scores. Despite findings from the literature

(Pennycook et al., 2017; Lucker et al., 1981; Cole, 1985; Chapanis, 1959) on the recognition of subjective measures such as student perception of performance / learning as a poor measure because of its subjective nature, it continues to be used in educational research without triangulation with other measures of actual learning. The following example exemplifies this situation. Researcher A conducted an experimental study to investigate the use of a new pedagogy tool to enhance students' English communication skills. After the intervention period, the students were asked to self-rate their confidence ability in communication skills. The research findings depicted a high confidence ability among the participating students. Then, Researcher B conducted a similar study using the same experimental design as Researcher A in examining the effect of the identical pedagogical tool in measuring students' English communication skills. However, in this instance, Researcher B measured participants' confidence ability in communication skills via a demonstration rather than self-report. After the intervention period, participants demonstrated better English communication skills and confidence ability. Based on the two studies by Researcher A and Researcher B, which study will influence the community of researchers on the effectiveness of the new pedagogical tool? Are the findings from participants' self-rated English communication skills from Study A equivalent to their actual performance through presentation skills in Study B?

To explore this debate, further research needs to be conducted to determine whether students' self-report of their confidence level in communication skills is equivalent to their actual performance based on the set of communication skills demonstrated. More empirical evidence is required to address the fundamental measurement criteria of validity. There is also a vital need for policymakers to recognize and practise consciousness in judgement pertaining to measurements from research findings, and to be particularly cautious in gathering, studying, and deciphering such subjective data.

To conclude in a nutshell, the authors strongly believe that the acceptance of perceived academic performance (a subjective measure) as a dependent variable of measurement should not be considered as a sole criterion measurement, rather it needs to be triangulated with other measures of actual performance. The use of objective measurements should be prioritized over subjective measures when

objective measurements are available, as studies on perception based on these subjective measures may not reflect knowledge gain, and thus this data should be used cautiously as a surrogate for evidence of actual learning.

ACKNOWLEDGMENT

This paper is based on research funded by Geran Penyelidikan Profesor, Research Management Centre, Universiti Teknologi MARA, Malaysia (600-RMC/GPP 5/3 (009/2021).

REFERENCES

Abramenka, V. (2015). *Students' Motivations and Barriers to Online Education* (Unpublished master's thesis). Grand Valley State University. https://scholarworks.gvsu.edu/cgi/viewcontent.cgi?article=1775&context=theses

Azzieatul Syazwanie Azmi, & Lai See May. (2021). The impact of open distance learning (ODL) on students' performance in Universiti Teknologi MARA Kelantan branch. In *Proceedings of International Conference on Language, Education, Humanities &Social Sciences* (i-LEdHS2021), 22 Febuari 2021, UiTM Cawangan Kelantan.

Bandura, A. (1977). Self-efficacy: Toward a unifying theory of behavioral change. *Psychological Review, 84*(2), 191–215. https://doi.org/10.1037/0033-295X.84.2.191

Banna, J., Lin, M.-F. G., Stewart, M., & Fialkowski, M. K. (2015). Interaction matters: Strategies to promote engaged learning in an online introductory nutrition course. *Journal of Online Learning and Teaching, 11*(2), 249–261.

Bettinger, E., & Loeb, S. (2017). Promises and pitfalls of online education. *Evidence Speaks Reports, 2*(15), 1–4.

Bettinger, E., Fox, L., Loeb, S., & Taylor, E. (2015). Changing distributions: How online college classes alter student and professor performance (CEPA Working Paper No.15–10). Stanford Center for Education Policy Analysis. http://cepa.stanford.edu/wp15-10

Bloomberg. (2022). UK probes grade inflation after 'sharp increase' in top degrees at universities. *Bloomberg*. https://www.bloomberg.com/news/articles/2022-09-01/investigation-after-sharp-increase-in-top-degrees-at-several-universities?leadSource=uverify%20wall

Britt, M. (2015). How to better engage online students with online strategies. *College Student Journal*, *49*(3), 399–404.

Cavanaugh, J. K., Jacquemin, S. J. (2015). A large sample comparison of grade based student learning outcomes in online vs. face-to-face courses. *Online Learning*, *19*(2), 1–8. https://doi.org/10.24059/olj.v19i2.454

Chapanis, A. (1959). *Research techniques in human engineering*. Baltimore, MD: Johns Hopkins University Press.

Cole, K. C. (1985, September). Is there such a thing as scientific objectivity? *Discover*, pp. 98–99.

Deslauriers, L. L., McCarty, K., Miller, K., Callaghan., & G. Kestin. (2019). Measuring actual learning versus feeling of learning in response to being actively engaged in the classroom. *Proceedings of the National Academy of Sciences of the United States of America*, *116*(39), 19251–19257. https://doi.org/10.1073/pnas.1821936116

Dixson, M. D. (2010). Creating effective student engagement in online courses: What do students find engaging? *Journal of the Scholarship of Teaching and Learning*, *10*(2), 1–13.

Dogan, U. (2015). Student engagement, academic self-efficacy, and academic motivation as predictors of academic performance. *The Anthropologist*, *20*(3), 553–561. https://doi.org/10.1080/09720073.2015. 11891759

Dunlosky, J., & Rawson, K. A. (2012). Overconfidence produces underachievement: Inaccurate self-evaluations undermine students' learning and retention. *Learning and Instruction*, *22*(4), 271–280. https://doi.org/10.1016/j.learninstruc.2011.08.003

Eastin, M. S., & LaRose, R. (2000). Internet self-efficacy and the psychology of the digital divide. *Journal of Computer-Mediated Communication*, *6*(1). https://doi.org/10.1111/j.1083-6101.2000.tb00110.x

Gallagher, S. (2021). *How to help high-achieving students manage stress?* https://teach.com/resources/high-achieving-students-manage-stress/

Gillett-Swan, J. (2017). The challenges of online learning: Supporting and engaging the isolated learner. *Journal of Learning Design*, *10*(1), 20–30. https://doi.org/10.5204/jld.v9i3.293

Hajar Mohd. Nor (2015). *Conditions facilitating the implementation of information and communication technology (ICT) integration in the Malaysia smart school* (Unpublished doctoral dissertation). Universiti Putra Malaysia, Serdang, Selangor. http://psasir.upm.edu.my/id/eprint/6548/

Hung, M. L., Chou, C., Chen, C. H., & Own, Z. Y. (2010). Learner readiness for online learning: Scale

development and student perceptions. *Computers & Education*, *55*(3), 1080–1090. https://doi.org/10.1016/j.compedu.2010.05.004

Jackon, L. C., Jones, S. J., & Rodriguez, R. C. (2010). Faculty actions that result in student satisfaction in online courses. *Journal of Asynchronous Learning Networks*, *14*(4), 78–96. https://doi.org/ 10.24059/OLJ.V14I4.129

Januszewski, A., & Molenda, M. (Eds.) (2007). *Educational technology: A definition with commentary. Definition and Terminology Committee of the Association for Educational Communications and Technology*, 1–14. Routledge.

Jessica, B. H., Nicholas, S., Elaine, A., Kirk, W., Jordan, R., Suzanne, S. T., & Valerie, M. (2017). The struggle to pass algebra: Online vs. Face-to-Face credit recovery for at-risk urban students. *Journal of Research on Educational Effectiveness*, *10*(2), 272–296. http://dx.doi.org/10.1080/19345747.2016.1168500

Joosten, T., & Cusatis, R., & Harness, L. (2019). "A cross-institutional study of instructional characteristics and student outcomes: Are quality indicators of online courses able to predict student success?" *Online Learning*, *23*(4), 354–378. https://doi.org/10.24059/olj. v23i4.1432

Norfadilah Kamaruddin. (2010). Interface design development: Malaysian's practice. *The International Journal of Learning*, *17*(8), 195–204.

Karadag, E. (2021). Effect of COVID-19 pandemic on grade inflation in higher education in Turkey. *PLOS ONE*, *16*(8). https://doi.org/10.1371/journal.pone.0256688

Karim, M. W., Haque, A., Ulfy, M. A., & Hossin, M. S. (2021). Factors influencing student satisfaction towards distance learning apps during the coronavirus (Covid-19) pandemic in Malaysia. *International Journal of Academic Research in Progressive Education and Development*, *10*(2), 245–260. http://dx.doi.org/10.6007/IJARPED/v10-i2/9546

King, S. B. (2014). Graduate student perceptions of the use of online course tools to support engagement. *International Journal for the Scholarship of Teaching and Learning*, *8*(1). https://doi.org/10.20429/ijsotl.2014.080105

Klassen, R. M. (2010). Confidence to manage learning: The self-efficacy for self-regulated learning of early adolescents with learning disabilities. *Learning Disabilities Quarterly, 33*, 19–30. https://doi.org/10.1177/073194871003300102

Krejce, R. V., & Morgan, D. W. (1970). Determining sample size for research activities. *Educational and Psychological Measurement, 30*, 607–610. https://doi.org/10.1177/001316447003000308

Kruger, J., & Dunning, D. (1999). Unskilled and unaware of it: How difficulties in recognizing one's own incompetence lead to inflated self-assessments. *Journal of Personality and Social Psychology, 77*(6), 1121–1134. https://doi.org/10.1037/0022-3514.77.6.1121

Lederman, D. (2020). *Will shift to remote teaching be boon or bane for online learning? Inside Higher Ed.* https://www.insidehighered.com/digital-learning/article/2020/03/18/most-teaching-going-remote-will-help-or-hurt-online-learning

Li, J., Ye, H., Tang, Y., Zhou, Z., & Hu, X. (2018). What are the effects of self-regulation phases and strategies for Chinese students? A meta-analysis of two decades' research of the association between self-regulation and academic performance. *Frontiers in Psychology, 9*, Article 2434. https://doi.org/10.3389/fpsyg.2018.02434

Lilian, A., Koo Ah Choo & Hew Soon Hin (2021). Investigating self-regulated learning strategies for digital learning relevancy. *Malaysian Journal of Learning and Instruction, 18*(1), 29–64. https://doi.org/10.32890/mjli2021.18.1.2

Loeb S. (2020). *Students who struggle will likely struggle more online*. https://www.edweek.org/ew/articles/2020/03/23/how-effective-is-online-learning-what-the.html

Lorenzo-Alvarez, R., Rudolphi-Solero, T., Ruiz-Gomez, M. J., & Sendra-Portero, F. (2019). Medical student education for abdominal radiographs in a 3D virtual classroom versus traditional classroom: A randomized controlled trial. *American Journal of Roentgenology, 213*(3), 644–650. doi: 10.2214/ajr.19.21131

Lucker, G. W., Beane, W. E., & Guire, K. (1981). The idiographic approach to physical attractiveness research. *Journal of Psychology, 107*, 57–67. https://doi.org/10.1080/00223980.1981.9915205

McVay, M. (2000). How to be a successful distance learning student: Learning on the Internet. Pearson Custom Publication.

Meyer, K. A. (2014). Student engagement in online learning: What works and why. *ASHE Higher Education Report, 40*(6), 1–114. https://doi.org/10.1002/aehe.20018.

Michaelides, M. (2008). Emerging themes from early research on self-efficacy beliefs in school mathematics. *Electronic Journal of Research in Educational Psychology*, *6*(1), 219–234.

Morris, L. (2020). Spring quarter snapshot: Interviews focus on how the coronavirus is changing work. https://www.ucdavis.edu/spring-snapshots/news/interviews-focus-how-coronavirus-changing-work

Moody, J. (2019). What a good college GPA is and why it matters. https://www.usnews.com/education/best-colleges/articles/2019-01-28/what-a-good-college-gpa-is-and-why-it-matters

Muda, Z., & Mohamed, R. (2016). Adaptive user interface design in multimedia courseware. *Proceeding of Conference on Information and Communication Technologies*, *16*(1), 196–199.

Pallot, R. M., & Pratt, K. (1999). Building learning communities in cyberspace.

Pennycook, G., Ross, R. M., Koehler, D. J., & Fugelsang, J. A. (2017). Dunning-Kruger effects in reasoning: Theoretical implications of the failure to recognize incompetence. *Psychonomic Bulletin & Review, 24*(6), 1174–1784. https://doi.org/10.3758/s13423-017-1242-7

Said, Ghada Refaat El. (2021). How did the COVID-19 pandemic affect higher education learning experience? An empirical investigation of learners' academic performance at a university in a developing country. *Advances in Human-Computer Interaction*, *3*, 1–10. https://doi.org/10.1155/2021/6649524

Soderstrom, N. C., & Bjork, R. A. (2015). Learning versus performance: An integrative review. *Perspectives on Psychological Science*, *10*(2), 176–199. http://doi:10.1177/1745691615569000.

Soesmanto, T., & Bonner, S. (2019). Dual mode delivery in an introductory statistics course: Design and evaluation. *Journal of Statistics Education*, *27*(2), 90–98. https://doi.org/10.1080/10691898.2019.1608874

Sparks, D. S. (2022). Pace of grade inflation picked up during the pandemic, Study says. *Education week.* https://www.edweek.org/leadership/pace-of-grade-inflation-picked-up-during-the-pandemic-study-says/2022/05#

Strauss, V. (2021). Grade inflation is just plain bad. Right? Maybe not. https://www.washingtonpost.com/education/2021/09/21/why-grade-inflation-is-useful/

Sun, P. C., Tsai, R. J., Finger, G., Chen, Y.-Y., & Yeh, D. (2008). What drives a successful eLearning? An empirical investigation of the critical factors influencing learner satisfaction. *Computers & Education, 50*(4), 1183–1202. Vo, H. M., Zhu, C., & Diep, N. A. (2017). The effect of blended learning on student performance at course-level in higher education: A meta-analysis. *Studies in Educational Evaluation, 53*, 17–28. http://doi: 10.1016/j.stueduc.2017.01.002

von Glasersfeld, E. (1983). Learning as a constructive activity. http://www.vonglasersfeld.com/083

Webb, E. J., Campbell, D. T., Schwartz, R. D., & Sechrest, L. (1966). Unobtrusive measures: Nonreactive research in the social sciences. Rand-McNally.

Wheatley, G. H. (1991). Constructivist perspectives on science and mathematics learning. *Science Education, 75*(1), 9–12. http://dx.doi.org/10.1002/sce.3730750103

Yang, J. C., Quadir, B., Chen, N. S., & Miao, Q. (2016). Effects of online presence on learning performance in a blog-based online course. *Internet and Higher Education, 30*, 11–20. https://doi.org/10.1016/j.iheduc.2016.04.002

York, T. T., Gibson, C., & Rankin, S. (2015). Defining and measuring academic success. *Practical Assessment, Research, and Evaluation, 20*(5), 1–20. https://doi.org/10.7275/hz5x-tx03

Zahir Osman, Wardah Mohamad, Ratna Khuzaimah Mohamad, Liana Mohamad, & Tuan Fatma Tuan Sulaiman. (2018). Enhancing students' academic performance in Malaysian online distance learning institutions. *Asia Pacific Journal of Educators and Education, 33*, 19–28. https://doi.org/10.21315/apjee2018.33.2