Eshet *International Journal for Educational Integrity* (2025) 21:3
https://doi.org/10.1007/s40979-024-00178-z

International Journal for Educational Integrity

ORIGINAL ARTICLE Open Access

Examining the dynamics of plagiarism: a comparative analysis before, during, and after the COVID-19 pandemic

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Abstract

This research explores the impact of the unforeseen global crisis on education and assessment practices, investigating plagiarism rates through a comprehensive analysis of 25,864 written assignments from 42 academic institutions in 2019, 2020, and 2023 before, during, and after crises, such as pandemics. Utilising the theory of planned behaviour comparing undergraduate plagiarism rates before, during, and after the COVID-19 pandemic using an automated plagiarism detection tool (Originality). The comparison traverses academic fields, disciplines, institutional rankings, and written language assessments. Contextualising this phenomenon is crucial for a comprehensive understanding and targeted interventions against undesirable behaviour. The results show that before and after COVID-19, plagiarism rates were similar, while during COVID-19, plagiarism rates augmented. Furthermore, assignments written in English contained higher plagiarism rates than those in Arabic and Hebrew. We discuss post-pandemic plagiarism rates bounce-back in higher education on the one hand and concern about artificial intelligence writing tools on the other hand. We also discuss plagiarism among multilingual students. The study concludes with practical implications and suggestions for future research in the evolving landscape of academic integrity.

Keywords Plagiarism, Plagiarism detection software, Higher education, Academic integrity

Introduction

Universities and colleges forge future generations' professional skills and values Lewis et al. (2019) while emphasising academic integrity (Eshet 2024). Consequently, addressing dishonest behaviour, particularly plagiarism, is crucial for the academic and professional development of undergraduates (Elkhatat et al. 2021). Besides, higher education assesses students' knowledge, often through written assignments(Gasmalla 2023). These assessments contribute to grading certification and foster analytical thinking and written communication skills (Ayu and Sabarun 2023). Maintaining the integrity of these assessments is vital to ensure originality (Elkhatat et al. 2021). However, challenges in

preserving this integrity can influence students' likelihood of plagiarism (Babatunde Adedoyin and Soykan 2023; Tindall et al. 2021). Plagiarism is a widespread phenomenon across academic disciplines, fields of study, and institutions (Yazici et al. 2023). Plagiarism encompasses various forms (Moss et al. 2018), from patch-writing to direct copying (Elkhatat et al. 2021; Tran et al. 2022).

There are many common plagiarism practices, such as copy and paste, patchwriting, boilerplate, paraphrasing, translation plagiarism, improper quotations, idea plagiarism, and citing invalid sources (Tauginienė et al. 2019). Plagiarism also extends beyond text, including artistic and code plagiarism, where images, videos, or code are used without proper citation or permission (Maurer et al. 2006). Plagiarism typically provides some benefit, credit, or gain, which need not be monetary (Tauginienė et al. 2019). Maurer et al. (2006) identify four broad categories of plagiarism: accidental, intentional, unintentional, and self-plagiarism. Although the concept of plagiarism is not new, the ways in which students plagiarise have evolved (Uzun and Kilis 2020).

An objective method to detect and combat plagiarism in academic settings is the use of plagiarism detection software, such as text-matching software products (Eshet 2024; Foltýnek et al. 2019). Text-matching software identifies similar parts of documents with quantitative measures (Özşen et al. 2023), lacking clarity on rewriting needs (Asamoah et al. 2024). Not all similarities found by text-matching software indicate plagiarism (Tauginienė et al. 2019). In other words, text-matching software aids in detecting plagiarism but needs academic interpretation.

While Turnitin is the most widely used plagiarism detection tool (Chandere et al. 2021), its ability to detect plagiarism in non-Latin languages, such as Arabic and Hebrew, is relatively limited (Zouaoui and Rezeg 2020). Hebrew and Arabic are Semitic languages, written from right to left, with common orthographic and complex morphologic features, where letters are connected, and their shape is altered based on their position within the word. (Cohen et al. 2024). The Arabic alphabet consists of 28 letters and the Hebrew alphabet of 22 consonants. In Arabic, there are optional diacritic marks resulting in a myriad of different word representations (Nagoudi et al. 2018). Despite the inadvisability of 30% similarity thresholds (Tauginienė et al. 2019), the officially authorised for Higher Education (The State Comptroller and Ombudsman 2017) automated plagiarism detection software specifically designed for the Hebrew language is "Originality" (Rohn 2011). Scores 70–100 indicate authenticity. Consequently, our research employs the Originality software to examine cross-institutional and interdisciplinary plagiarism in Israeli higher education institutions, as aligned with previous research (Eshet 2024) and institutional policies (The State Comptroller and Ombudsman 2017).

Amidst the ongoing digital transformation in higher education (Babatunde Adedoyin and Soykan 2023), the global impact of the COVID-19 pandemic compelled institutions to shift to online platforms and emergency remote teaching (ERT) (Broadbent et al. 2023). These changes had significant effects on academic integrity rates across all educational levels (Gamage et al. 2020). Previous research has explored factors influencing plagiarism, including the delivery mode and the influence of the COVID-19 pandemic, often finding variations in plagiarism values across institutions and disciplines (Cahyadi et al. 2022; Eshet 2024; Yazici et al. 2023). Despite extensive research on plagiarism, there remains a lack of consistency in the results (Mokdad and Aljunaidi 2020; Uzun and Kilis 2020).

In light of potential future disruptions, be they human situational incidents or natural disasters, educational institutes may encounter challenges requiring increased reliance on Emergency Remote Teaching (ERT) (Whittle et al. 2020). As significant changes impact the educational experience, effective coping becomes a crucial ability (Agbaria and Mokh 2021; Browning et al. 2021). Therefore, building on prior work (Eshet 2024), this study addresses the literature gap regarding the challenges in the pre-, peri-, and post-pandemic future of higher education and their connection to plagiarism grounded on Ajzen's (1991) theory of planned behaviour (TPB), the widely used theory to understand plagiarism (Flom et al. 2023; Uzun and Kilis 2020). This psychological theory seeks to explain and predict human behaviour by emphasising the roles of attitudes, subjective norms, and perceived behavioural control. The theory offers valuable insights into the formation of behavioural intentions and the translation of these intentions into action (Uzun and Kilis 2020; Zhang 2024). This pioneering study aims to quantitatively measure plagiarism rates using an originality plagiarism detection tool before, during, and after COVID-19. Key research questions explore differences in plagiarism incidences across time spans, academic disciplines, higher education rankings, and institution types, as well as variations based on written assessment language.

Theoretical background

The ongoing advancements in information and communication technology have brought about significant shifts in the nature of technology-enhanced learning activities (Dai et al. 2023). The COVID-19 pandemic, in particular, precipitated a substantial increase in online education (Li and Lalani 2020), opening the door for different forms of online education, including asynchronous online learning (Han et al. 2023), hybrid teaching and learning and emergency remote teaching (Eshet et al. 2021). Scholarly research has attested to the pedagogical divergences between online and face-to-face teaching (Badiozaman 2021). Still, there is the need to unveil digital integrity behaviour (Miller 2019), as undergraduates are required not only to master their subject areas but also to be ethically responsible citizens (Khathayut et al. 2022).

Now, the pandemic's impact on unethical behaviours, including attitudes towards plagiarism, has been well documented (Al-Nuaimi and Uzun 2023). Previous research indicates that the intent to plagiarise is influenced by students' attitudes towards plagiarism and the learning environment (Khathayut et al. 2022). Drawing on Ajzen (1991) theory of planned behaviour (TPB), behavioural intentions hinge on attitudes, social norms and perceived control. Additionally, planned behaviour involves target, action, context, and time frame (Ajzen 2020).

Plagiarism before-during and after-COVID-19

Plagiarism is a broad term that encompasses various types of academic misconduct (Thomson et al. 2023). It can be classified in multiple ways: (a) Intentionality: accidental, intentional, unintentional self-plagiarism- and (b) the level of seriousness of the offence: minor and major (Tauginienė et al. 2019). Intentional plagiarism includes students' pretence to work hard and intentionally passing off others' ideas as their own to earn credit. Accidental, unintentional or negligent plagiarism is due to the challenges faced by students in mastering the standards of good academic practice or when including others' ideas without properly marking them as such (Şimşek 2024). Unintentional plagiarism

is common in higher education due to limited awareness of ethical nuances, leading to poor judgment (Prashar et al. 2024).

Plagiarism is one of the oldest offences in academia (Tollefson 2024) and threatens educational integrity (Foltýnek et al. 2020). There are different definitions of plagiarism; nonetheless, the main focus is the use of ideas, words, or other works without proper acknowledgement or explicit citation (Drisko 2023). Put differently, plagiarism encompasses various forms: duplication of written text, software code, images, videos, and other types of intellectual property. While plagiarism broadly covers these forms, this study specifically examines plagiarism in written assignments, as they are the most frequently assessed within academic institutions (Eshet 2024). Written assignments are essential for assessing students' knowledge and skills, and this research analyses trends in text-based plagiarism affecting academic success. In addition, they are particularly challenging for those acquiring a foreign language (Hassan 2023).

Research comparing online and face-to-face plagiarism (Yazici et al. 2023) discovered a higher frequency of cheating in online learning settings. Others (Kratovil 2021) found higher plagiarism rates during the pandemic compared to pre-pandemic levels. Eshet (2024) also described that the transition to ERT is associated with decreased academic integrity, especially in humanities. Thus, based on previous research concerning disparities in plagiarism rates before and during COVID-19, we posit:

H_1 *Plagiarism incidences will differ before, during and after COVID-19.*

Plagiarism and academic disciplines

Academic discipline represents a distinct branch of knowledge (Becher and Trowler 2001), sometimes sharing common study themes (Sneddon 2009) arranged into larger clusters or areas (Hider and Coe 2022) or broadly categorised into several major fields, each encompassing numerous sub-disciplines (Tight 2020). Each discipline adheres to specific writing and citation conventions, and these differences can influence academic dishonesty practices (Kelly 2022; Merkel 2021).

The United Nations Educational Scientific and Cultural Organization (2012) hard/soft academic characteristics framework classifies humanities, arts, social sciences, business, and law (SSH) as 'soft' and science, engineering, manufacturing, construction, and health sciences (STEM) as 'hard' (Becher and Trowler 2001; Hedges 1987). In Israel, undergraduate studies are available in seven major fields: Education and Teaching, Social Sciences, Business and Economics, Law, Architecture, and the Arts (SSH), as well as Engineering, Computer Studies, and Health Sciences (STEM) (Council for Higher Education 2024). These fields differ in terms of student selectivity and the equivalence between university and college programs (Ayalon and Yogev 2005).

Previous research (Eshet 2024) found differences in plagiarism rates among SSH and STEM students. Hodges et al. (2017) found lower academic performance among SSH students, while others (Michelle and Kari 2023) suggest that STEM students are more likely to plagiarise than their counterparts in the humanities. Consequently, there are differences in academic integrity according to the academic fields (Drisko 2023). Kratovil (2021) has noticed an increase in plagiarism incidences among nursing students during the COVID-19 pandemic and a change in trend: although prepandemic plagiarism was mainly found in lecture-based courses, plagiarism occurred more in lab-based courses

during the pandemic. Guba and Tsivinskaya (2021) found higher plagiarism levels in physics dissertations than in math. Additionally, the authors found a higher incidence of plagiarism in the social sciences fields of economics, pedagogy, psychology, and political science.

The effects of the COVID-19 pandemic crossed academic disciplines (Aristovnik et al. 2020). Not all literature that concerns differences among academic disciplines and fields has focused on plagiarism per-se, as many studies have more generally focused on academic integrity or academic dishonesty. Nevertheless, we can infer from these ethical differences that there may also be differences in plagiarism, as it is a specific breach of academic integrity. Previous research compared before and during pandemic plagiarism incidents and found differences across disciplines and fields (Eshet 2024). Thus, based on the above and previous research, we hypothesise that:

H_2 Plagiarism incidences will differ among academic fields and disciplines before, during, and after COVID-19.

Academic ranking and plagiarism

Higher educational rankings have become a tool for comparing academic institutions' success and quality (Bellantuono et al. 2022). Rankings also represent institutional prestige and excellence, impacting researchers and companies as well as the levels of funding institutions earn (Musselin 2018). Because of the importance of funding, academic institutions must maintain high professional standards (Gamage et al. 2020). Therefore, institutional rankings have become more prominent, which has raised the need to understand how they may affect the higher education industry and its values (Bojadjiev et al. 2023).

Different global ranking types developed with different agendas and criteria (Nassa and Arora 2021), with the Times Higher Education World University Ranking (THE), the QS World University Rankings, and the Academic Ranking of World Universities (ARWU) being three of the most prominent. Institutions are measured by different metrics within each rank (i.e. number of lecturers with PhDs, research output, and students' academic results), which are all related to scientific productivity (Szluka et al. 2023).

This study fostered the Webometrics Ranking of World Universities to measure institutional ranking. Webometrics entails the largest number of institutions compared to other global ranking systems (Memisevic and Memisevic 2022), as it assesses an institution's web presence and impact (Fauzi et al. 2020). Each institution is ranked based on three scales (impact, openness, and excellence) and receives a world rank and a rank within each country (Consejo Superior de Investigaciones Cientificas 2023). Additional subclassification groups ranked institutions as top-ranked, mid-ranked, and lower-ranked (Musselin 2018; Rider et al. 2020). Based on the results of previous research and the negative relationship previously found between Webometrics rank and plagiarism (Eshet 2024), we hypothesise that:

H_3 Plagiarism incidences will differ according to the institution's ranking before, during and after COVID-19.

Plagiarism and written assignment languages

There are two types of plagiarism when referring to the written assessments' language: monolingual and cross-lingual. Monolingual plagiarism occurs when the source and the assignment are written in the same language (Mansoor and AlTamimi 2022). Cross-lingual plagiarism, which is becoming more profound as translation tools evolve, refers to translating an original work in one language to present the translated text as one's own in another language (Dinneen 2021). In the multilingual sample of the current study, these transitions between languages are highly relevant.

The Israeli higher education system was chosen as a case study due to the exceptionally high proportion of Israelis with higher education qualifications, which ranks among the highest globally (Cohen 2022; Sirota 2023). Israel's higher education sector includes research-intensive universities, some in the top 200 globally (Yemini 2021). The Israeli higher education sector consists of eight research universities, an open university, 20 budgeted (public) academic colleges, 21 teacher-training colleges, and 13 private colleges (Allalouf et al. 2020). Israel is a multilingual, multicultural (Stavans 2023) and multi-ethnic society (Lewin-Epstein and Cohen 2019). Hebrew and Arabic are *de facto* the official languages, and English serves as a secondary or international language. The linguistic repertoire of Israel includes Amharic, Arabic, English, French, German, Hai, Hebrew, Mandarin, Nepali, Portuguese, Russian, Spanish, Tagalog, Tigrinya, and Yiddish, among many other languages (Stavans 2023).

Language instruction is part of the Israeli educational system from an early age, thus creating a multilingual society in which most individuals have some proficiency and written literacy in at least two languages (Tannenbaum et al. 2022). More specifically, proficiency in English is recognised as a necessity for participation in the economy (Spolsky and Shohami 1999); therefore, Israeli higher education institutions greatly emphasise English proficiency and written literacy. Most institutions, specifically universities, require a standard level of written literacy in English, and all higher education institutions offer general or discipline-specific English courses to students who lack such an ability (Deutch 2003). Given the linguistic diversity of Israeli students, the following hypothesis is proposed:

H_4 Plagiarism incidences will differ among written assignments in different languages before, during and after COVID-19.

The present study

This research builds upon prior work on plagiarism (Eshet 2024) and explores variations in plagiarism occurrences before, during, and after crises, such as pandemics. The study aims to fill the literature gaps in understanding plagiarism incidents during unforeseen events like pandemics, conflicts, and earthquakes. Utilising the theory of planned behaviour (Ajzen 1991, 2020), the investigation compares undergraduate plagiarism rates before, during, and after the COVID-19 pandemic using an automated plagiarism detection tool (Originality). The comparison traverses academic fields, disciplines, institutional rankings, and written language assessments. Contextualising this phenomenon is crucial for a comprehensive understanding and targeted interventions against undesirable behaviour.

Methods

Data collection

The dataset comprises 25,864 assignments from 42 out of 62 Israeli higher education institutions, including all nine universities and 33 colleges. Assignments were selected from December 2019 (pre-pandemic), December 2020 (during the shift to Emergency Remote Teaching), and February 2023 (post-pandemic). Data were systematically sampled by selecting every tenth assignment submitted over two consecutive months. Figure 1 shows the timeline of COVID-19 in Israel, aligning with our data sampling dates. All 42 institutions in the sample have a code of ethics addressing academic dishonesty, plagiarism prevention, and the corresponding penalties.

Instruments

Originality text-matching detection software is a software-as-a-service (SaaS) plagiarism detection (text-matching) solution. *Originality* uses a plugin to interact with various learning management systems (LMS) and is used by 70% of Israeli higher education institutions. The software compares written assignments against large national online sources (such as university databases and graduate and undergraduate course sites) and identifies places where texts overlap (Rohn 2011). Originality text-matching software identifies plagiarism incidences in written assignments in Arabic, English, and Hebrew. An "originality report" is produced with an overall originality score for each assignment, ranging from 0 (being completely nonoriginal) to 100 (being completely original). Accordingly, in line with The State Comptroller and Ombudsman (2017) and based on the threshold of similar software in previous studies (Carter and Blanford 2016), a score between 70 and 100 indicates that the submitted work is authentic, whereas a grade below 70 indicates that the assignment has little or no original work.

Webometrics Ranking of World Universities (WRWU) is one of the most extensive academic ranking systems available (Fauzi et al. 2020). Thousands of higher education institutions from more than 200 countries in the WRWU are ranked based on data from online sources (e.g., Google Scholar and Scimago). Ranking criteria of WRWU include the university's web access, presence, and visibility. Six of our 42participating institutions

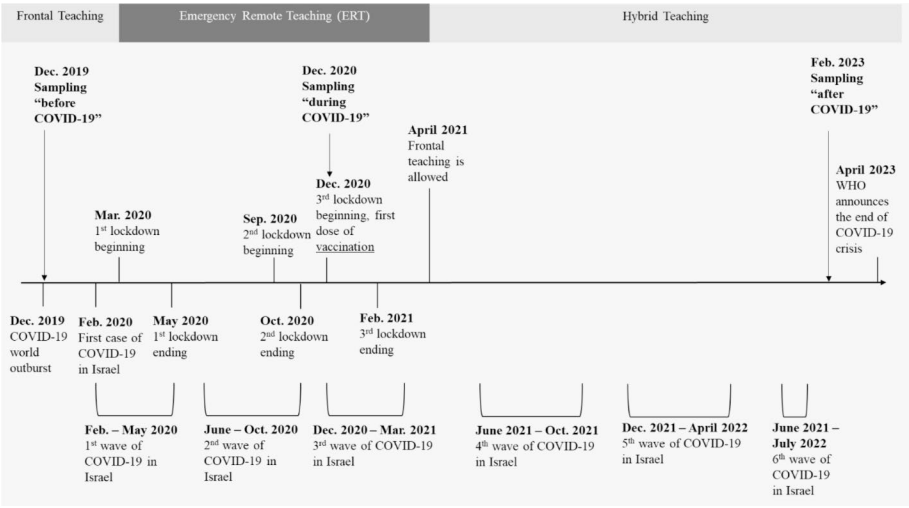

Fig. 1 COVID-19 timeline in Israel and sampling dates

achieved a high ranking (1 to 1,000), 26 achieved a medium ranking (1,001–9,999), and 10 achieved a low ranking (10,000 to 20,000) or were not ranked.

Procedure

Students' assignments were assessed before (December 2019), during (December 2020), and after (February 2023) the COVID-19 pandemic. The data collected from Originality text-matching records included the originality score, submission date, course name, institution's name, and language of the assignment. Human evaluations by the researcher added information on the academic field, discipline, type of institution, and global ranking. Disciplines were categorised into hard (STEM) and soft (SSH) based on Hedges (1987) and Becher and Trowler (2001) dimensions. Assignments' originality indices were broadly grouped into plagiarised and non-plagiarised, with a minimum score of less than 70 defining an academic integrity breach.

Data analysis

After the assignment collection, we used an Excel spreadsheet to organise the similarity indices and other research variables. After uploading the file to IBM SPSS version 28 statistics software, we used Cramer's V coefficient and Pearson's correlation coefficient (r_p) to assess correlations between variables. Differences in plagiarism incidents between levels of relevant variables were evaluated by ANOVA; Eta squared are reported as effect sizes for ANOVA. All tests were 2-sided, and statistical significance was set to $p<0.05$ ("*"), 0.01 ("**"), and 0.001 ("***").

Results

Cramer's V coefficient was used to explore the correlation between time and the originality category. Submitted assignments were considered nonoriginal, hence plagiarised, if they had an originality score of less than 70 (i.e., a large amount of plagiarised text). As presented in Table 1, the results showed that time significantly correlates with originality ($V=0.08$, $p<0.001$). This analysis contained two degrees of freedom, thus resulting in a relatively small correlation. The mean percentage of nonoriginal work increased from 22.3% before the pandemic to 33.8% during the pandemic, indicating a rise in plagiarism during COVID-19. There has been a decline in the percentage of nonoriginal work from during to after the pandemic (24.8%), yet levels are still higher than before COVID-19 (22.3%), thus confirming H_1.

One-way ANOVA was performed to separately compare plagiarism incidences before, during, and after the pandemic for each type of academic field. Results in Table 2 present significant differences in originality scores between the three COVID-19 time periods (before, during, and after) in both SSH ($F_{(2,21204)}=75.6$, $p<0.001$) and STEM ($F_{(2,4654)}=20.6$, $p<0.001$). Similar to the trend in Tables 1 and 2 shows that

Table 1 Cramer's V coefficient between time and originality category

		Before COVID-19	During COVID-19	After COVID-19	Cramer's V
Original work	n	3096	2644	13,446	0.08***
	Percent	77.7%	66.2%	75.2%	
Nonoriginal work	n	887	1349	4445	
	Percent	22.3%	33.8%	24.8%	

Note: *$p<0.05$; **$p<0.01$; ***$p<0.001$

Table 2 Differences in plagiarism incidences by academic field of study

Academic field	COVID-19	*N*	Mean	SD	F	η^2
SSH	Before COVID-19	3194	83.21	27.05	75.60***	0.01
	During COVID-19	3544	74.50	31.12		
	After COVID-19	14,469	79.60	29.59		
STEM	Before COVID-19	789	80.24	27.35	20.60***	0.01
	During COVID-19	449	70.72	32.57		
	After COVID-19	3419	80.33	30.33		

Note: *$p<0.05$; **$p<0.01$; ***$p<0.001$

Table 3 Differences in plagiarism incidences by academic discipline

Indicate Originality		Academic disciplines					
		Humanities ($n=5821$)	Social Science ($n=15386$)	Exact Sciences ($n=3564$)	Health Sciences ($n=1093$)	F	η^2
Before COVID-19	M	87.47	81.16	80.60	78.83	15.45***	0.11
	SD	(24.22)	(28.09)	(26.61)	(30.11)		
During COVID-19	M	69.94	77.95	69.07	76.22	22.59***	0.13
	SD	(32.90)	(29.25)	(34.09)	(26.32)		
After COVID-19	M	73.51	81.37	81.12	77.85	62.41***	0.10
	SD	(33.69)	(28.05)	(30.71)	(29.01)		
Percentage change Before and After COVID-19	Δ	15.9%	0.25%	0.65%	1.25%		

Note: *$p<0.05$; **$p<0.01$; ***$p<0.001$

plagiarism incidences in both the SSH and STEM fields increased during the pandemic and decreased before and after it. The mean originality score after the pandemic in SSH fields (M=79.60) was higher than during the pandemic (M=74.50 during), yet did not reach the same level as before COVID-19 (M=83.21). In the STEM fields, the mean originality score after COVID-19 (M=80.33) is similar to the score before the pandemic (M=80.24).

We performed one-way ANOVA to investigate differences in plagiarism incidences among four academic disciplines separately for each period (Table 3). Results show significant differences between academic disciplines before ($F_{(3,3979)}=15.45$, $p<0.001$), during ($F_{(3,3989)}=22.59$, $p<0.001$), and after the pandemic ($F_{(3,17884)}=62.41$, $p<0.001$), thus confirming H_2. Among all four disciplines, originality scores dropped during the pandemic and went up after it. In humanities and health sciences only, originality scores after the pandemic (M=73.51, SD=33.69 for humanities; M=77.85, SD=29.01 for health sciences) are still lower than before the COVID-19 pandemic (M=87.47, SD=24.22 for humanities; M=78.83, SD=30.11 for health sciences). Originality scores in the humanities showed a drop of 15.9% from before COVID-19 to after the pandemic, while health sciences showed a drop of only 1.25%. Interestingly, originality scores after COVID-19 in the social sciences (M=81.37, SD=28.05) and exact sciences M=81.12, SD=30.71) in our sample seem to have not only recovered to where they were before the pandemic (M=81.16, SD=28.09 for social sciences; M=80.6, SD=26.61 for exact sciences) but they also had an increase of less than 1%.

Table 4 presents the results of one-way ANOVA for differences in plagiarism incidences between high, medium, and low-ranked institutions within each time span and Pearson correlation coefficients between ranking and originality score. Results show significant differences between high, medium, and low-ranked institutions before

Table 4 Differences in plagiarism incidences by institutional ranking

Indicate Originality		**Academic institution Ranking**					
		High ranked (*n* = 6622)	**Medium ranked (*n* = 13966)**	**Low ranked (*n* = 5271)**	**F**	**η^2**	***rp***
Before COVID-19	M	87.17	83.61	79.19	24.50***	0.11	-0.081***
	SD	(23.90)	(26.36)	(29.02)			
During COVID-19	M	80.45	72.56	69.90	37.92***	0.13	-0.137***
	SD	(29.71)	(30.26)	(33.10)			
After COVID-19	M	82.86	79.95	73.02	90.83***	0.10	-0.095***
	SD	(28.56)	(29.46)	(31.95)			
Percentage change Before and After COVID-19		4.9%	4.3%	7.7%			

Note: *$p<0.05$; **$p<0.01$; ***$p<0.001$

Table 5 Differences in plagiarism incidences by language and period

	Language	***N***	**Mean**	**SD**	**F**	**η^2**
Before COVID-19	Hebrew	3673	84.03	26.23	74.52***	0.04
	Arabic	175	70.81	24.97		
	English	134	59.10	37.82		
During COVID-19	Hebrew	3259	77.10	29.61	113.73***	0.05
	Arabic	158	75.08	26.21		
	English	566	56.19	35.93		
After COVID-19	Hebrew	13,877	81.35	27.65	126.24***	0.02
	Arabic	785	81.44	29.09		
	English	3173	72.17	36.71		
All Sample	Hebrew	20,809	81.16	27.80	261.98***	0.02
	Arabic	1118	78.88	28.37		
	English	3873	69.38	37.11		

Note: *$p<0.05$; **$p<0.01$; ***$p<0.001$

($F_{(2,3979)}=24.5$, $p<0.001$), during ($F_{(2,3983)}=37.92$, $p<0.001$), and after ($F_{(2,17888)}=90.83$, $p<0.001$) COVID-19. All effect sizes were medium ($0.06 < \eta^2 < 0.14$), thus confirming H_3. In all three pandemic periods, low-ranked institutions have the lowest mean originality score. Furthermore, while high and medium-ranked institutions show a percentage change of below 5% from before to after COVID-19, low-ranked institutions show a decrease of 7.7% in originality scores from before to after the pandemic. Additionally, we found significant negative correlations between institutional ranking and originality before (r_p=-0.081, $p<0.001$), during (r_p=-0.137, $p<0.001$), and after (r_p=-0.095, $p<0.001$) the pandemic.

One-way ANOVA was performed to compare plagiarism incidence levels between assignments written in different languages. As shown in Table 5, we found significant differences in plagiarism rates among the three languages (Arabic, English, and Hebrew) before ($F_{(2,3979)}=74.52$, $p<0.001$), during ($F_{(2,3980)}=113.73$, $p<0.001$), and after ($F_{(2,17832)}=126.24$, $p<0.001$) the pandemic, but when including all three periods together ($F_{(2,25797)}=261.98$, $p<0.001$), though, effect sizes were small ($\eta^2 < 0.06$). Thus, H_4 is confirmed.

Discussion

Higher education institutions cope with a myriad of anticipated and unanticipated challenges, necessitating adaptation to create a "new normal". Unforeseen circumstances, such as the global impact of events like COVID-19, pandemics, crises, wars,

and catastrophic natural disasters, have become pervasive, significantly affecting education worldwide (Szecsi et al. 2023). These disruptions have led to pedagogical changes, contributing to dishonest academic behaviours and plagiarism (Eshet 2024; Eshet et al. 2023). The pandemic has introduced novel educational dilemmas, with post-pandemic contemplation highlighting plagiarism as one of the crucial issues (Eringfeld 2021).

The results reveal an increasing trend in plagiarism, with a peak observed during the pandemic and a subsequent decline (almost bouncing back) in the post-pandemic period, confirming H_1. One contributing factor could be the proliferation of communication technologies, including the Internet, which has facilitated access to a broad array of texts anytime and anywhere (Sakamoto and Tsuda 2019). During the COVID-19 pandemic, this shift to online learning was significant, though other factors also likely influenced this outcome. As education transitioned predominantly online, all assignments and examinations were submitted digitally, facilitating the use of text-matching software by institutions. The absence of direct supervision in online learning environments, in contrast to traditional classrooms, potentially increased opportunities for students to engage in dishonest practices, whether intentionally or inadvertently. Another reason could be that stress, anxiety, and uncertainty induced by the pandemic may have prompted students to take shortcuts, thereby raising the likelihood of plagiarism. Additionally, many institutions adopted open-book or take-home exams, which, although alleviating memorisation pressure, heightened the temptation or perceived need to replicate from accessible sources.

Institutional factors such as academic support, online learning infrastructure, and the quality of emergency remote teaching (ERT) could have also impacted plagiarism rates. Institutions with strong online systems and robust support structures might have better maintained academic integrity, whereas those struggling with ERT might have seen increased plagiarism. While the study acknowledges the shift to ERT, it does not thoroughly examine how differences in ERT quality and methods across institutions affected plagiarism rates. Variations in institutional responses, including anti-plagiarism measures and support for students and faculty, likely played a crucial role in the observed differences. The bouncing-back trend could be attributed to the heightened readiness and willingness of faculty and staff to conduct online teaching and design courses tailored for a hybrid environment. This might have influenced students' positive attitudes towards academic integrity or diminished their inclination to deceive lecturers for personal gain, aligning with the TPB (Ajzen 1991) and reducing dishonest tendencies.

Our findings further reveal varying incidences of plagiarism across academic fields and disciplines, thereby confirming H_2. This aligns with existing literature, which suggests that students in STEM disciplines are more prone to plagiarism compared to those in the humanities or social sciences (Michelle and Kari 2023). Throughout the pandemic, the humanities exhibit a more pronounced rise in plagiarism incidents. Post-pandemic plagiarism rates in the humanities differ from pre-pandemic levels, whereas in all other academic fields, post-pandemic rates align with those before the pandemic.

One possible explanation, based on the TBP (Ajzen 1991, 2020), could stem from distinct attitudes and perceived norms related to ethical behaviour fostered by faculty and students in each respective discipline. It is important to note that there are some unique ethical concerns in the humanities and that discussion of ethical misconduct outside the scientific fields is lacking. In addition, each discipline often adheres to specific writing

and citation rules (Merkel 2021) and different academic dishonesty practices (Kelly 2022). Such interdisciplinary differences may have far-reaching implications when transitioning to an online learning design (Smith et al. 2009). In addition, though SSH fields showed lower plagiarism incidences before and during the pandemic compared to STEM fields, it seems that post-COVID-19 plagiarism incidences are similar in the two fields. These results add to the mixed findings about comparing academic integrity in SSH and STEM (Eshet 2024; Hodges et al. 2017; Su et al. 2018). This trend change might result from today's multidisciplinary approach in general and specifically in academia, which evolved and became more prominent as the COVID-19 pandemic progressed and interdisciplinary cooperation was needed. This new approach might have promoted an unstated consensus regarding norms and attitudes on academic (dis)honesty, which, according to the TPB, can encourage lower rates of unethical behaviour (Ajzen 1991, 2020; Hendy et al. 2021).

The results show that institutional global ranking is related to plagiarism rates before, during, and after the pandemic, thus confirming H_3. These results might support the notion that institutional ranking entails ethical considerations and that higher-ranked institutions also maintain higher ethical standards (Abbas et al. 2021). Our findings also indicate significant differences in originality scores between institutions of varying ranks. One possible interpretation is that top-ranking institutions can select the most qualified students, who might generally possess a stronger understanding of plagiarism norms (Hussein 2022).

In other words, second-tier institutions are generally less selective compared to those in the top tier, where admissions are predominantly based on test scores, including high school grades and psychometric assessments (Allalouf et al. 2020). In contrast, the admissions criteria for second-tier colleges are more flexible (Ayalon and Yogev 2005). These differences may reflect variations in academic resources and support rather than moral disparities. Higher-ranked institutions might offer better plagiarism education and resources, while lower-ranked ones might lack such support, affecting unintentional plagiarism. These differences do not necessarily imply a disparity in educational quality.

An alternative explanation, supported by research (Yesmin and Atikuzzaman 2023), suggests that the limited comprehension of ethical terminology and research methodologies among early-career faculty members may adversely affect both the quality of education and the rankings of universities. Notwithstanding, these findings also demonstrate the need to facilitate more honest behaviours among students and faculty in lower-ranked institutions because of the interchange between ethical behaviour in the academic world and ethical behaviours in students' future workplaces (Guerrero-Dib et al. 2020).

Our findings show higher plagiarism rates in English written assignments compared to Arabic and Hebrew in all pandemic stages, thereby confirming H_4. These results support previous literature concerning high plagiarism rates in a foreign language (MacLeod and Eaton 2020), as English is a foreign language for most Israeli students. In line with the literature, many students fall under the plagiarism act of "patchwriting," which is when one fails to paraphrase and integrate someone else's idea in one's own words. Most Israeli students are native speakers of a Semitic language (Arabic and Hebrew) and may lack Germanic native (English) written literacy. Additionally, students may be less aware of citation and rephrasing norms in English, or what is considered inappropriate

rephrasing, as a result of a lack of proficiency, which, according to the TPB (Ajzen 1991, 2020), might increase their tendency to plagiarise. Lastly, students may feel less confident in their English written literacy, which has been proven to affect plagiarism.

Conclusions and practical implications

The unexpected global COVID-19 pandemic disrupted daily routines worldwide, challenging cognitive processes, influencing behavioural intentions, and requiring adaptation (Ling et al. 2023). Higher education was one such space that was directly affected by the pandemic (Eshet and Margaliot 2022), as all education branches, academic integrity (Gamage et al. 2020), and plagiarism rates experienced notable changes (Eshet 2024). Students may commit plagiarism either intentionally or unintentionally. Therefore, addressing and preventing plagiarism requires a comprehensive institutional strategy involving all stakeholders (Uzun and Kilis 2020). In addition, the likelihood of future global closures, whether due to human incidents or natural disasters, is evident and will impact education (Browning et al. 2021); therefore, post-pandemic rethinking is crucial.

This study reveals that plagiarism rates are higher during unforeseen crises than during routine periods - both before and after COVID-19 - across various disciplines. These findings suggest that the propensity to engage in plagiarism increases under stressful conditions. The challenges of higher education can be overwhelming and stressful (Chemagosi and Barongo 2024), and stress may predict intentions to plagiarise, mediated by positive attitudes and subjective norms towards plagiarism (Tindall et al. 2021). Additionally, relying solely on text-matching software to detect plagiarism may lead to false positives or negatives (Tauginienė et al. 2019). Educators should carefully review reports, assess the severity of offences, and consider adopting a student entrepreneurial behaviour approach to learning (Sá and Holt 2019).

In addition, COVID-19 has raised concerns about student well-being and academic misconduct (Eaton et al. 2023). Therefore, emphasising the importance of moral learning codes for students' professional future becomes crucial. Given the likelihood of future unexpected emergencies challenging the routine teaching and learning environment, institutions are encouraged to develop comprehensive emergency teaching plans and provide educators with adequate resources to manage emergencies and associated stressors.

This research constitutes a case study of a multicultural and multilingual society, focusing on Israeli students. Based on our results and previous research (Eshet 2024), we deduce that students' written literacy influences their ability and attitude to plagiarise. Consequently, we suggest reinforcing academic writing literacy and ethical practices. This, in turn, will also be efficient for the institution, as with more students able to write assignments and papers in an international language while maintaining the ethical codes, the better the presence of an institution may be, which can increase its global rank.

The research findings offer practical implications for educational institutions, policymakers, and educators:

- Develop comprehensive emergency teaching plans that address potential closures, ensuring strategies for upholding academic integrity and preventing plagiarism during transitions to online or hybrid learning.

- Provide educators with adequate resources and support to navigate emergencies, including training programs to adapt to new teaching modalities and maintain ethical standards in assessment.
- Emphasise academic writing literacy by offering workshops and resources to enhance students' proficiency in written communication, particularly in languages other than their native ones.
- Ongoing research on the impact of unforeseen events on academic integrity is essential, offering insights into effective strategies for maintaining ethical standards in education.

Limitations and future research

The study has several limitations. Firstly, the Originality detection software anonymises assignments, preventing an examination of potential relationships with intrapersonal variables. Nonetheless, the Originality software - mandatory in all Israeli academic institutions (The State Comptroller and Ombudsman 2017)– may not address false positives. A further limitation of plagiarism detection software is its ability to uncover cross-lingual cases, which may result in frequent false negatives. Poor translations or significant grammatical errors can obscure the original text, preventing the software from accurately matching copied content to sources. Consequently, undetected plagiarism underestimates true prevalence and misrepresents academic integrity.

Another limitation is unintentional plagiarism. Research indicates that the most common forms of plagiarism are unintentional, arising when students fail to adhere to proper protocols for citing academic material, likely due to insufficient knowledge (Elander et al. 2010). Originality software detects text overlap but not intent, potentially inflating plagiarism rates and overestimating intentional misconduct, particularly among students with limited academic skills or working in non-native languages. Accordingly, there is a need for a more thorough academic interpretation (Tauginienė et al. 2019), which may occasionally result in misinterpretation (Özşen et al. 2023). Eventually, plagiarism detection software may serve as a tool to aid individuals in correctly citing and referencing their work, thereby diminishing the likelihood of inadvertent plagiarism. (Mulenga and Shilongo 2024).

Secondly, the study focuses on Israeli academic institutes, limiting generalizability. Cultural attitudes towards plagiarism and academic integrity vary between countries, affecting the study's generalisability. For example, differing norms and practices in Israel may influence perceptions and management of plagiarism. Nonetheless, previous research found no significant differences in academic dishonesty between American and Israeli students, and the study's specific context may impact the results. Assignments were predominantly in Hebrew, Arabic, and English, potentially influencing statistical analysis outcomes. While the sample may represent multilingual countries and those where English is taught as a foreign language, caution is advised when generalising results.

The Theory of Planned Behaviour (TPB) (Ajzen 1991, 2020) theory is widely used to understand plagiarism (Flom et al. 2023; Uzun and Kilis 2020). TPB offers a valuable framework for understanding variations in plagiarism rates, as it addresses the influence of attitudes, subjective norms, and perceived behavioural control on individuals' intentions and actions. However, while TPB provides useful insights, it may not fully capture

all factors influencing plagiarism. Future research could explore alternative theories, such as Social Learning Theory or the Theory of Moral Development, to provide additional insights by emphasising the role of social influences and moral reasoning. Integrating these theories with the Theory of Planned Behaviour (TPB) may deepen our understanding of the complex dynamics underlying plagiarism behaviour.

Further studies could explore causal relationships among variables, assess various plagiarism types, and investigate motivational factors during emergency transitions to digital learning. Other studies may compare plagiarism rates in exams and written assignments in different languages and analyse the potential for a markedly increased risk of false negatives in assignments arising from cross-language plagiarism. Additionally, future research may conduct longitudinal studies to track changes in academic dishonesty over extended periods, beyond the immediate pre- and post-pandemic phases, as well as comparative analysis of plagiarism trends in different educational systems or comparison of subjective and objective reporting.

The research lacks specification of the learning environment before and after the pandemic, impacting the ability to differentiate between face-to-face (F2F), hybrid, and fully online courses. The dataset reflects the impact of transitioning between non-ERT and ERT but does not allow a direct comparison between different learning environments.

The study does not consider the introduction of Artificial intelligence-based writing tools like ChatGPT, which could influence plagiarism and unethical behaviour. While AI tools can generate human-like texts, the study's similarity-based plagiarism detection tool may not consistently identify Artificial intelligence-generated text as nonoriginal or plagiarised. Future research should explore the relevance of similarity-based tools in detecting Artificial Intelligence-based plagiarism.

Abbreviations

ARWU	Academic Ranking of World Universities
ERT	Emergency Remote Teaching
LMS	Learning Management Systems
QS	World University Rankings
SSH	Social Sciences and Humanities
STEM	Science, Technology, Engineering, and Mathematics
THE	Times Higher Education World University Ranking
TPB	Theory of Planned Behaviour
WRWU	Webometrics Ranking of World Universities

Acknowledgements
We would also like to express our gratitude to Mrs. Ariane Cukierkorn, Information Specialist, for her helpful and constructive comments and suggestions, and for her help proofreading and editing the manuscript.

Author contributions
Not applicable.

Funding
This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

Data availability
Data and materials would be sent upon request.

Declarations

Ethics approval
The study was approved by the Ethics Committee of the. The consent Zefat Academic College was given in written form (number of decision: RDR 15051).

Competing interests
The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Received: 26 February 2024 / Accepted: 15 November 2024

Published online: 17 January 2025

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Publisher's note

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