

## ORIGINAL RESEARCH

### Investigating Factors Associated with Physical Education Classes in Mexico During COVID-19

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#### Abstract

*This study analysed the physical education (PE) sessions during the COVID-19 forced confinement from the perspective of teacher participation. Participants in the study included 674 PE teachers from different cities in Mexico, of which 446 (66.2%) are women and 228 (33.8%) are men. With an average age of  $40.39 \pm 10.3$ , they taught at the preschool (14.8%), elementary (77%) and high school (8.2%) educational levels. An ad hoc questionnaire called "The Physical Education Session during Confinement by COVID-19" was designed for this study. This instrument was reviewed and corrected by experts in PE teaching and research. The first section of the questionnaire consisted of sociodemographic information, and the second section comprised 22 items encompassing five factors: hygiene recommendations, planning, space and material distances, collaboration and teamwork, and use of technology. PE classes during COVID-19 were conducted 60 to 80 per cent online, and the most frequent means of communication was WhatsApp (65.4%). The questionnaire showed adequate psychometric properties (RMSEA = .05; GFI = .88, CFI = .99, NFI = .97; Chi-square/gl = 3.66). The factors showed no significant differences by gender ( $p > .05$ ); teachers who were university graduates scored higher on all factors ( $p < .01$ ) than those from normal schools. Finally, all factors were positively and significantly correlated ( $p < .01$ ). The study concludes that teaching PE during the COVID-19 contingency involved modifications of the teaching intervention. Understanding how to tailor-fit these interventions to respond to student needs appropriately is of utmost importance in maintaining physical and mental health during a global health crisis.*

#### Introduction

The impact of the COVID-19 crisis on educational institutions, educators, students, and their families has been profound. One of

the earliest and most significant impacts felt globally was the swift action taken by school authorities to mitigate the disruption to the academic calendar and ensure the continuity of learning. In March 2020, UNESCO convened an online assembly of education

#### Keywords:

well-being, mental health, accessible education, primary education, secondary education

#### Recommended Citation:

Ceballos Gurrola, O. (2024). Investigating factors associated with physical education classes in Mexico during COVID-19. *International Sports Studies*, 46(1), 22-35, <https://doi.org/10.69665/iss.v46i1.3>

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ministers to share insights into the various strategies adopted by their respective nations to support teachers, parents, and students in navigating the challenges of remote learning (Huang et al., 2020). As a result, the Government of Mexico disseminated comprehensive preventive measures to the public, suspending in-person classes and commencing distance learning initiatives (Secretaría de Educación Pública, 2020).

Authors such as Chang and Yano (2020) have proposed various alternatives to mitigate the educational interruptions caused by the pandemic, aiming to ensure the universal continuity of the teaching-learning process. Their primary recommendation involved expanding existing forms of distance education and disseminating educational content through digital and traditional media channels, including television. In response to these exigencies, educators, particularly those in PE, were compelled to adapt rapidly. They recalibrated and refined their pedagogical strategies, initially designed for in-person instruction, to innovate for virtual student engagement, concurrently undergoing preparation and acquiring proficiency in the use of technology (Lloyd, 2020).

Oranburg (2020) posits that achieving optimal practices in online education necessitates both time and resources. Designing and implementing a successful online course requires hundreds of hours, a luxury that is unavailable amidst the urgency of the global crisis. The states of emergency declared worldwide demanded swift responses. Nevertheless, amidst this crisis, the primary objective remains to create an optimal student experience. The conception, planning, design, and development of an online course or program can consume up to a year of faculty training and collaboration with instructional designers.

Moreover, it often necessitates guidance and support from students and a

sophisticated technological infrastructure. Throughout the COVID-19 pandemic, educators encountered various challenges, particularly in the pedagogical domain of PE. Teachers were required to navigate a non-traditional context, delivering instruction outside the conventional classroom setting. This necessitated the implementation of a virtual framework with diverse avenues for guiding students in developing their motor skills (Juanes Giraud & Rodríguez Hernández, 2021). This shift complicated the provision of feedback, correction, movement tracking, and assessment of students' progress and evolution (Hall-López & Ochoa Martínez, 2020). The role of PE teachers in elementary school students is to facilitate the development of physical literacy, which can be achieved when students encounter a range of appropriate opportunities at each stage and age.

Blended Learning is a pedagogical approach combining online and face-to-face instruction to harness both strengths for more efficient learning. This approach has emerged as a transformative modality in distance education, enriched by new technological resources and innovative methodological proposals. It has overcome challenges and progressed toward new possibilities that ensure the quality of semi-presential education (García-Ruiz et al., 2017). Furthermore, information and communication technologies (ICTs) are regarded as instruments that facilitate parental involvement in their children's education, given their pervasive integration into contemporary societies. Moreover, research indicates a positive stance among families towards using ICTs to facilitate children's learning. Teachers significantly influence how parents utilise ICTs to support their children's education. Teachers' beliefs regarding the role of families in children's education also influence parents' use of ICTs (Urías et al., 2017).

PE plays a pivotal role in the comprehensive development of students. As such, ensuring its delivery safely and responsibly is essential, prioritising the well-being of teachers and students. Adherence to health recommendations is thus paramount to facilitating the development of fundamental competencies among students and providing them with the skills and opportunities necessary to promote health and well-being, which is particularly vital in these uncertain and challenging times (CONSEJO COLEF, 2020). Virtual PE should aim to enhance physical abilities and cultivate critical thinking and adaptive strategies for navigating the post-COVID-19 era, which is characterised by its unique challenges (Carrasco Coca et al., 2021). It is well-established that engaging in moderate to vigorous physical activity significantly contributes to maintaining cognitive functions and is directly associated, in most cases, with improved mental health outcomes (Cruz-Sánchez et al., 2011). Furthermore, engagement in physical activity enables students to fulfil their psychological needs and perceive their well-being more positively (Mahecha Matsudo, 2019).

Another concerning aspect is the prevalence of poor nutrition and sedentary behaviours, which contribute to Mexico's staggering obesity rate of 72.5%, placing it among the top five countries globally affected by this issue (Flores Olivares et al., 2021). Implementing lockdown measures during the pandemic prompted a shift in lifestyle behaviours, increasing sedentary activities (Hall-López et al., 2020). This is a significant public health concern, as sedentary behaviour is the fourth leading cause of mortality worldwide and is responsible for 27% of global diabetes prevalence, 30% of ischemic heart disease, and over 20% of breast and colon cancers (Bull et al., 2020). The World Health Organization, the American Heart

Association, and the American Diabetes Association frequently emphasise the importance of maintaining an active lifestyle (American Heart Association, 2024). However, the temporary closure of sports and recreational facilities during lockdowns has hindered physical activity opportunities. Physical activities mitigate physical health problems and alleviate psychological issues (Warburton & Bredin, 2017).

Establishing a programme for virtual PE classes during quarantine and sustaining these activities post-quarantine as normalcy resumes is imperative (Tascón, 2020). Beyond the COVID-specific circumstances, preparing students adequately for a future that must and can be improved is paramount (Hall-López & Ochoa Martínez, 2020). This study is particularly relevant in promoting adaptations to circumstances surrounding COVID-19. Physical education instructors are cognizant of the impact of conducting their classes online on maintaining students' physical activity levels and overall health, particularly in fortifying the immune system and mitigating sedentary behaviour and obesity. Thus, this study aims to scrutinise the factors associated with PE during COVID-19 confinement.

## Methodology

The present study is a non-experimental cross-sectional study conducted within the same timeframe (Ato et al., 2013). Comparative and correlation analyses were performed using criteria from the PE questionnaire constructed and administered during the COVID-19 confinement.

The study's target population was in-service PE teachers in basic education. A sample of 674 PE teachers was drawn, of which 446 (66.2%) are women and 228 (33.8%) are men, with an average age of  $40.39 \pm 10.3$ . An ad hoc questionnaire called "Factors associated with the Physical

Education class during confinement by COVID-19 from the teacher's perspective" was designed for this study. PE teaching and research experts reviewed and corrected this instrument. It consisted of a first section with eight questions on sociodemographic data: age, gender, educational level and system, academic training, federal entity, media, and percentages of application of the PE program during confinement. The second section had 22 items encompassing five factors: hygiene recommendations, planning, distances, spaces and materials, collaboration and teamwork, and use of technology, employing a Likert-type response scale ranging from 1 (totally disagree) to 7 (totally agree).

The questionnaire was digitally captured through the Google Forms® platform. It incorporated a section informing the participant about the research objectives, stating the confidentiality of the data, and requesting their consent to participate. Subsequently, the survey was distributed exclusively to PE teachers through e-mails and social networks. As inclusion criteria, only PE teachers who were in service at the time of the study and who answered the survey in their entirety were considered in the study. Due to the questionnaire's characteristics and questions, the participants' integrity and morals were always respected. Ethical aspects of qualitative research are considered, with a social and scientific value where a study that leads to the production of knowledge that provides opportunities for improvement or solution of problems in the field of Physical Education is proposed (Cámara de Diputados del H. Congreso de la Unión, 2014). The Research Coordination of the School of Sports Organization of the Universidad Autónoma de Nuevo León (REPRIN-FOD-74) approved and registered the project. Once the data were captured, they were analysed using the SPSS v25 statistical program. First, the data were cleaned and analysed for quality. Second, descriptive

statistics of frequencies and percentages of the sociodemographic data were obtained. After that, the items included in the instrument were analysed using mean, standard deviation, skewness, and kurtosis. Then, the exploratory factor analysis (EFA) was performed with half of the sample, obtaining the Kaiser-Meyer-Olkin coefficient (KMO), Bartlett's test of sphericity, and conducting the principal component analysis extraction method, and the Varimax rotation method. In addition, the confirmatory factor analysis (CFA) was performed using the model's goodness-of-fit indexes (Jöreskog & Sörbom, 2006). Reliability was determined for each factor, and the results were calculated using Cronbach's alpha index. Comparisons were also carried out using the student's t-test according to gender and academic training, and finally, the correlations between factors using Pearson's coefficient were computed.

## Results

The results of the teacher's perspective in the PE class during COVID-19 confinement are described below. First, the frequencies and percentages of the sociodemographic variables are described. Subsequently, the instrument's EFA and CFA were carried out with half of the sample since it is a new questionnaire. Finally, the factors are compared by gender and type of academic training (regular school and university), and a correlation analysis is presented.

### *Sociodemographic Data*

The socio-demographic data are shown in Table 1, with higher participation of PE teachers in the age groups of 31-40 years (31.5%) and 41-50 years (30.6%). Higher participation of women (66.2%) with teaching at the primary education level (77%) belonging to the federal education system (79.8%) with university education (51.9%),

and the primary communication system between teacher and student was WhatsApp (65.4%)

Table 1. Frequencies and percentages for the age groups of PE teachers

Sociodemographic variables		Frequencies	Percentages
Age	< 20 years old	5	7
	21-30 years old	132	19.6
	31-40 years old	212	31.5
	41-50 years old	206	30.6
	> 51 years old	119	17.7
Gender	Female	446	66.2
	Male	228	33.8
Educational level	Preschool	100	14.8
	Primary	519	77
	High School	55	8.2
Educational system	Federal	538	79.8
	State	96	14.2
	Private	40	5.9
Academic background	Normal School	324	48.1
	University	350	51.9
Social Media	E-mail	33	4.9
	Facebook	88	13.1
	WhatsApp	441	65.4
	Virtual Platform	94	13.9
	Phone Call	18	2.7

*Descriptive Statistics of the Items*

A normality test (skewness and kurtosis), as well as the mean and standard deviation of the items, was performed. The items did not

comply with normality by having values outside the range of -1 and 1, as seen in Table 2.

Table 2. Descriptive statistics of the items

Items	Mean	SD	Skewness	Error of Skewness	Kurtosis	Error of Kurtosis
1	6.10	1.28	-1.667	.133	2.833	.266
2	5.35	1.42	-.668	.133	-.003	.265
3	5.77	1.44	-1.209	.133	.814	.265
4	6.22	1.07	-1.484	.133	1.893	.265
5	6.21	1.23	-1.757	.133	2.626	.265
6	5.91	1.44	-1.645	.133	2.570	.265
7	5.73	1.68	-1.328	.134	.861	.266
8	6.13	1.33	-1.995	.133	4.159	.265
9	6.25	1.28	-2.189	.134	4.927	.267
10	6.10	1.45	-2.014	.133	3.830	.266
11	5.95	1.44	-1.539	.133	1.931	.266
12	5.83	1.50	-1.405	.133	1.376	.266
13	5.82	1.37	-1.095	.133	.420	.266
14	5.59	1.69	-1.126	.133	.381	.266
15	4.82	1.63	-.689	.134	-.116	.266
16	6.56	.97	-3.130	.133	12.075	.266
17	6.46	1.13	-2.781	.133	8.526	.266
18	6.49	1.03	-2.989	.133	10.908	.266
19	6.54	.98	-2.797	.133	9.203	.266
20	6.44	1.17	-2.613	.133	7.104	.266
21	6.29	1.34	-2.239	.133	4.933	.266
22	6.42	1.21	-2.458	.134	5.943	.266

Note: SD= Standard Deviation

### *Exploratory Factor Analysis*

The EFA of the instrument was performed with half of the sample (n=337) is shown below. The sample adequacy index KMO (Kiser Meyer Olkin) was satisfactory (KMO = .916). Bartlett's test of sphericity presented values of chi-square ( $X^2$ ) = 4357.929,  $g/1$  = 231, and  $p$  = .000, which are highly significant, thus assuming that the variables present high correlations.

Table 3 shows the factorial structure of the tool to evaluate the perception of the PE teacher regarding online classes, where the distribution of the items in each resulting factor is observed. The weights load on five factors: F1 Hygiene recommendations (from

items 1 to 7), F2 Planning (from items 8 to 12), F3 Distances, spaces, and materials (from items 13 to 16), F4 Collaboration and teamwork (from item 17 to 19), F5 Technology (from item 20 to 22).

### *Confirmatory Factor Analysis*

Confirmatory Factor Analysis allows us to observe the theoretical model's relevance or goodness of fit, representing the relationship between the studied variables. According to Jöreskog and Sörbom (2006), to check the fit between the theoretical model and the data matrix, adequate fit indices are obtained: (RMSEA= .05; GFI= .88, CFI= .99, NFI= .97; Chi-square/ $g/1$ = 3.66).

Table 3. Factor structure matrix

Items	Hygiene recommendations	Planning	Distances, spaces and materials	Teamwork	Technology	Communalities
1	.869					.842
2	.854					.833
3	.849					.811
4	.835					.797
5	.833					.782
6	.816					.766
7	.790					.751
8		.732				.577
9		.651				.528
10		.631				.532
11		.615				.485
12		.600				.551
13			.748			.676
14			.702			.667
15			.677			.627
16			.631			.532
17				.787		.710
18				.781		.764
19				.716		.638
20					.859	.811
21					.830	.762
22					.594	.647

*Comparisons of the Factors*

When performing the Kolmogorov-Smirnov normality test, significant differences were reported in the factor averages ( $p < .01$ ), which shows that they do not have a normal

distribution. Table 4 shows that no significant differences were found between the factors by gender ( $p > .05$ ), which means that women and men perceive each factor very similarly.

Table 4. Comparison of factors by gender

Factors	Gender	N	Media	DE	Mann-Whitney U Test	Z	P value																																												
1. Hygiene recommendations	Female	445	6.48	1.04	49171.500	-.317	.751																																												
	Male	224	5.51	.88				2. Planning	Female	446	5.92	.98	49569.000	-.257	.797	Male	225	6.99	.79	3. Distances, spaces and materials	Female	446	5.96	1.18	49477.500	-.204	.839	Male	224	6.01	1.05	4. Teamwork	Female	445	6.04	1.17	48751.000	-.377	.706	Male	223	5.97	1.20	5. Technology	Female	445	5.37	1.32	49481.000	-.153	.879
2. Planning	Female	446	5.92	.98	49569.000	-.257	.797																																												
	Male	225	6.99	.79				3. Distances, spaces and materials	Female	446	5.96	1.18	49477.500	-.204	.839	Male	224	6.01	1.05	4. Teamwork	Female	445	6.04	1.17	48751.000	-.377	.706	Male	223	5.97	1.20	5. Technology	Female	445	5.37	1.32	49481.000	-.153	.879	Male	224	5.36	1.29								
3. Distances, spaces and materials	Female	446	5.96	1.18	49477.500	-.204	.839																																												
	Male	224	6.01	1.05				4. Teamwork	Female	445	6.04	1.17	48751.000	-.377	.706	Male	223	5.97	1.20	5. Technology	Female	445	5.37	1.32	49481.000	-.153	.879	Male	224	5.36	1.29																				
4. Teamwork	Female	445	6.04	1.17	48751.000	-.377	.706																																												
	Male	223	5.97	1.20				5. Technology	Female	445	5.37	1.32	49481.000	-.153	.879	Male	224	5.36	1.29																																
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	Male	224	5.36	1.29																																															

When comparing the factors by academic training, significant differences ( $p < .01$ ) were observed in all factors, with those who

were university graduates scoring higher (Table 5).

*Table 5. Comparison of factors by academic training*

Factors	Training	N	Media	DE	Mann-Whitney U Test	Z	P value
1. Hygiene recommendations	Normal school	324	6.44	.98	49411.500	-	.004
	University	345	6.54	.99		2.902	
2. Planning	Normal school	324	5.85	.94	49126.000	-	.005
	University	347	6.03	.90		2.836	
3. Distances, spaces and materials	Normal school	323	5.86	1.16	48525.500	-	.002
	University	347	6.09	1.11		3.045	
4. Teamwork	Normal school	324	5.89	1.21	48157.500	-	.002
	University	344	6.13	1.14		3.107	
5. Technology	Normal school	324	5.24	1.29	48261.500	-	.002
	University	345	5.48	1.33		3.067	

Table 6 shows the mean, standard deviation, correlation, and Cronbach's Alpha for each factor in the diagonal line. All factors

correlate positively and significantly ( $p < .01$ ).

*Table 6. Mean, standard deviation, correlation, and reliability of factors*

Factors	1. RH	2. Planning	3. DEM	4. TE	5. Technology
1. RH	.93				
2. Planning	.475**	.77			
3. DEM	.559**	.527**	.82		
4. TE	.450**	.489**	.394**	.78	
5. Technology	.413**	.466**	.390**	.411**	.96

Note: RH = Hygiene Recommendations; DEM= Distances, Spaces and Materials; TE= Teamwork; \*\*  $p < .0$

## Discussion

This research investigated the factors associated with teacher participation in PE sessions during COVID-19. To this end, a questionnaire with 22 items encompassing the five factors of Hygiene Recommendations, Planning, Distances, Spaces and Materials, Teamwork, and

Technology was designed and administered. Each factor is deemed indispensable for implementing the online class; however, the study sought to analyse the perceptions of PE teachers on the implications of these factors on the teaching and learning of PE amidst the pandemic.



The profile of the PE teacher in Mexico showed an age range of 31 to 50 years old, predominantly women, teaching their classes at the primary education level, belonging to the federal education system, with a university education. The findings reveal that WhatsApp was the primary means of communication between teachers and students. Training PE teachers has been an essential component of the educational policy in Mexico, which orients its plans and programs toward affirming core educational principles and, particularly, the integral development of students in basic education (Secretaría de Educación Pública, 2002). There are teacher training schools (specific to teaching) and universities, with the latter offering diverse programs for graduates in PE, physical activity, and sports sciences. This variety in educational backgrounds among the research participants may explain why they registered higher scores in the factors studied.

The integral development of students is fundamental for PE, which is why various hygiene recommendations are provided to allow them to participate in PE activities effectively and safely, reducing the risk of contagion (Blocken et al., 2020). In the present study, the essential recommendations provided by PE teachers were wearing a face mask most of the time unless the activity was of higher intensity and was conducted in outdoor spaces, washing hands frequently, respecting a healthy distance, and using antibacterial gel, among others. For this, it was necessary to establish a work team that coordinated the activities of healthy school action, assessed the needs of students and conducted programs to promote healthy habits that favour the integrity of students (CONSEJO COLEF, 2020).

Although this study was conducted during the COVID-19 lockdown, many hygiene recommendations are still relevant to face-to-face classes post-pandemic.

Adherence to these preventive measures is essential for instilling healthy lifestyle habits in students, fostering their development within PE classes, and enabling them to maintain these habits daily.

Although many teachers did not feel prepared to incorporate technology into their classrooms shortly after the pandemic was declared (Molinero Bárcenas & Chávez Morales, 2019), it became necessary to incorporate ICT at home and in the classroom to provide students with quality learning. For the online PE class, different means of communication were used. The present study revealed that WhatsApp (65.4%) was used the most, although Facebook and other virtual platforms were also used less frequently. Baena-Morales et al. (2022) found that 67.8% of learning interactions with Spanish students occurred through virtual platforms like Moodle and Google Classroom. Social networks such as TikTok, Twitter, Instagram, Facebook, WhatsApp, and YouTube were also used to transmit activities and assignments. These platforms have become a fundamental part of young people's and adolescents' lives (Piedra, 2020). Social interactions frequently revolve around these social networks, driven by technological progress transforming how people socialise. For young people, being present and actively engaged in social networks is crucial for acquiring social capital. Many strive to keep up with the latest trends, publish engaging content, gain followers, and become influencers (Enríquez Reyna et al., 2021).

Within this context, PE teachers have an excellent opportunity to provide quality care while enhancing their professional image in society by being responsive to learner needs in a constantly changing world. Their experience during COVID-19 has prepared them for challenges should a resurgence of COVID-19 happen, compelling another social confinement and

restriction to face-to-face education. Hall-López & Ochoa Martínez (2020) emphasise that the use of virtual education, Apps and social networks has become a handy tool in the science of physical activity, the teaching of PE at the basic level, and increasing levels of physical activity during and beyond the pandemic.

Several studies affirm ICT as an essential resource for PE classes (Browne, 2015; López de la Varga et al., 2023); however, most PE teachers admitted to not being used to technology applications in class (Kretschmann, 2015). This becomes a challenge for teachers and parents, who constantly struggle to update themselves, working hard to better use and manage technology. The confinement may have restricted the content taught in PE, either because the virtual mode makes certain activities impossible or because teachers prioritised the content most effective for improving students' psychological and physical health (Baena-Morales et al., 2021).

The General Council of Physical and Sports Education (CONSEJO COLEF, 2020) developed a series of recommendations for online teaching. This means that PE teachers must incorporate the measures described by the council for face-to-face classes with the telematic teaching recommendations they deem appropriate, depending on their students, resources, and computer resources available.

While the study was conducted during the pandemic and may seem limited in relevance to the post-COVID-19 educational system, it highlights the crucial factors that have permanently influenced PE teaching and learning, such as student physical and mental health, innovation and maintenance of sport facilities and equipment, enhancement of collaboration and teamwork across multiple platforms, and, notably, incorporation of ICTs into the PE curriculum. Future research endeavours should explore

these factors in greater depth and examine their adaptation to the evolving educational norms, particularly in developing nations.

## Conclusion

The closure of schools due to the COVID-19 pandemic compelled the adaptation of remote learning models, with information and communication technologies (ICT) assuming a pivotal and indispensable role across all educational and professional fields, including healthcare. This situation necessitated the need to devise an instrument to assess the implications of the crisis on PE from the lens of teachers in Mexico. This study successfully validated the questionnaire "Factors Associated with Physical Education Classes during the COVID-19 Lockdown from the Teacher's Perspective," demonstrating its validity and reliability through robust psychometric properties.

The continued provision of PE during the pandemic required a rapid adaptation of pedagogical practices, underscoring its critical role in supporting physical and mental well-being during prolonged confinement. Physical education instructors were at the front line of promoting physical activity for the youth within safe home environments, ideally involving family participation. Instilling healthy habits during formative years is a cornerstone for enhancing overall health and establishing sustainable healthy lifestyles into adulthood. In this context, this article examines various factors associated with PE classes, exploring methods of promoting health, addressing the challenges posed by the COVID-19 pandemic, and combating obesity, a serious public health threat in Mexico.

The study revealed that WhatsApp was the primary mode of communication for online PE classes among students, parents, and teachers, with less frequent use of virtual platforms and Facebook. The interactivity

afforded by these platforms, coupled with their extensive accessibility to information resources regardless of temporal or geographical constraints, facilitated the acquisition of relevant knowledge and skills among students in Mexico amidst the global health crisis.

### Acknowledgement

The author would like to thank the PE teachers working in elementary and preschool schools and the Mexican Ministry of Education directors for supporting this study.

### Funding

This research did not require funding to be carried out.

### Disclosure statement

The author declares no conflicts of interest related to this research.

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