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Primary school children's oral hygiene knowledge assessed with different educational methods: a cross-sectional study

Canan Bayraktar Nahir[1*], Alem Coşgun[1], Necibe Damla şahin[1] and Halenur Altan[2]

Abstract

Background Different educational methods play an important role in oral hygiene education programs. This study aims to evaluate the impact of various educational methods on the oral hygiene knowledge of primary school children.

Methods A total of 490 primary school students participated in this cross-sectional study. The students were assigned to one of three groups: a verbal explanation group, an animation group, or a peer-led reels group. Before and after the intervention, the students completed questionnaires assessing their oral hygiene knowledge.

Results A significant increase was observed in the post-educational knowledge levels of the children in three educational methods ($p < 0.001$). The study found that the main effect of educational methods was statistically significant ($p < 0.001$). However, effects of gender, and tablet/mobile phone use, respectively, were not statistically significant ($p = 0.694$, $p = 0.641$). The animation group (6.73) and the verbal expression group (6.57) had the highest post-training knowledge levels, respectively, while the peer-led reels group had the lowest (5.95) ($p < 0.001$).

Conclusions All three educational methods are effective in promoting oral hygiene, but due to the accessibility and consumption of information in the current technological era, animation videos may be more useful and suitable for modern education.

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Keywords Dental health education, Primary school, Children, Video-audio demonstration, Peer influence

Background

Learning in children is an active and socio-cognitive activity [1]. In this complex learning process, various methods such as lectures, brochures, and videos are employed in education [2]. In the modern era, it is believed that educational methods for children should be engaging and utilize communication tools that children are familiar with, such as electronic devices [3].

A study emphasizes that a multimedia teaching environment, an innovative method, is effective in enhancing children's learning capacity. It is also stated that initiating the oral and dental health protection and prevention

*Correspondence:
Canan Bayraktar Nahir
canannbayraktarr@gmail.com
[1]Department of Pediatric Dentistry, Faculty of Dentistry, Tokat Gaziosmanpaşa University, Tokat, Türkiye
[2]Department of Pediatric Dentistry, Faculty of Dentistry, Necmettin Erbakan University, Konya, Türkiye

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program with multimedia tools is more beneficial for school-aged children. Therefore, it is necessary to investigate the contribution of various educational methods to the knowledge adopted in oral and dental health education [4].

Oral and dental health education begins with the education and practices of parents, who can further contribute through oral and dental health promotion programs [5]. Dentists and dental hygienists play a fundamentally important role in promoting adequate concepts in this field [6]. Education provided by experts helps children change their oral hygiene habits and maintain good oral health [7, 8]. Traditional education styles, supported by visual aids such as dental models, are considered crucial for developing oral and dental health knowledge due to their long-term impact on the target audience [9, 10]. To encourage children's understanding, various methods, including videos and animations, are employed by animating static visual aids [11]. It is reported that education provided through animation techniques will make it easier to explain complex concepts and thus make them easier to understand and remember [12].

Peer-led education, one of the methods that enables children to absorb information more easily, is defined as an education program in which students of similar ages teach their peers and holds an important place in the literature [13]. One study suggests that peer leaders are as effective as, or even more effective than, teachers when communicating with children [14]. Additionally, with the advancement of technology and the increasing use of social media tools, studies have reported that Instagram is a platform frequently used by students for educational activities and that reels videos are widely utilized [15, 16].

Various educational tools, such as brochures, videos, oral presentations, and animations, have been employed in studies providing oral and dental health education to children in the literature [3, 4, 17, 18]. However, no study has yet been identified that incorporates peer-led reels videos in this context.

Considering the various effects of technological advancements and the educational methods available to children in the current era, we believe that a peer-led reels video providing information about oral and dental health may be effective.

The aim of this study is to evaluate the effects of different educational methods on the knowledge levels of primary school children regarding oral hygiene. The first null hypothesis is that there will be no difference in the level of knowledge acquired by children about oral hygiene in terms of education with verbal explanation, animation video and peer-les reels video. The second null hypothesis is that gender and tablet/mobile phone use will have no effect on the knowledge acquired.

Methods

Ethical approval

The current study was approved by the Clinical Research Ethics Committee at the Medical School of Tokat Gaziosmanpaşa University (Approval No. 21-KAEK-275, dated 30.12.2021). The study was conducted in accordance with the guidelines of the Helsinki Declaration and adhered to the Consolidated Standards of Reporting Trials (CONSORT) guidelines.

Sample size calculation

The sample size was estimated using G Power software v.3.1.9.2. A minimum of 592 children was required to detect a significant difference using the "ANCOVA: Fixed Effects, Main Effects, and Interactions" test, with a type I error (α) of 0.05, power (1-beta) of 95%, and effect size of 0.162 [4].

Study design

This cross-sectional study included 5th grade students aged 10–12 years from primary schools located in the center of Tokat, Turkey. All 28 primary schools in Tokat's central district were contacted with the permission of the Provincial Directorate of National Education, and the purpose of the study was explained to the school principals. Fifteen schools equipped with visual communication devices and sound systems were selected. Informed consent forms were sent to the parents of students in these selected schools. The study was conducted between January and June 2022 in conference halls or classrooms within the schools.

Inclusion criteria for the study were 5th grade primary school children without any mental, visual, or auditory disabilities, and whose parents had provided written consent for their participation.

The study questions were developed by 4 expert pediatric dentists following a comprehensive literature review [3, 4, 17]. The questions were designed to to assess the children's knowledge of oral hygiene. In order to ensure the validity of the questions, the opinions of 8 additional expert paediatric dentists were obtained. The ratings of the expert opinions in the Lawshe [19] technique were graded as 'Appropriate', 'Appropriate but should be corrected' and 'Should be removed'. The experts were asked to tick one of the above ratings for each of the 8 items in the form. In order to calculate the content validity rates of the scale, 'Appropriate' was scored as 3, 'Appropriate but should be corrected' as 2 and 'Should be removed' as 1. In order to determine the content validity of the items to be included in the scale, the qualitative data obtained in line with the expert opinions were converted into quantitative data by calculating the content validity rate and content validity index. In this transformation process, first the content validity ratio and then the content validity index

Table 1 Questions measuring general knowledge of oral and dental health

Questions
Q1. How often should we brush our teeth?
Q2. How long should we brush our teeth for?
Q3. How much toothpaste should we use?
Q4. What brushing motion should we use when brushing our teeth?
Q5. Which areas of the mouth should we brush?
Q6. Should we use an interdental brush or dental floss?
Q7. How often should we visit the dentist?
Q8. How often should we replace our toothbrush?

were calculated. Calculations were made with Microsoft Excel 2016 programme. The calculation confirmed their conformity with a coefficient of 0.78 [20]. The questionnaire used was developed for this study.

The questionnaire was divided into two parts. The first part collected demographic datas, such as age, gender, and tablet/mobile phone usage. The second part consisted of 8 questions assessing general knowledge about oral hygiene (Table 1). Each correct answer was scored as 1 point, while incorrect and unanswered questions received 0 points.

A total of 490 students who completed the baseline questionnaire were randomly assigned to one of three groups: verbal explanation group, animation group, or peer-led reels group (Fig. 1). For randomisation, the completed questionnaires were numbered and participants were assigned to groups by making a table of random numbers in microsoft excel 2016.

In the verbal explanation group, a researcher wearing a white coat provided a one-time, 3-minute oral hygiene education session using a jaw model.

In the animation group, oral hygiene education was presented to the children once as a cartoon video lasting 1 min and 17 s (via Windows Media Player). The animation video was created by the researcher using the test version of "www.vyond.com". The animation featured a character voiced by one of the researchers, along with informative text and background music. The character

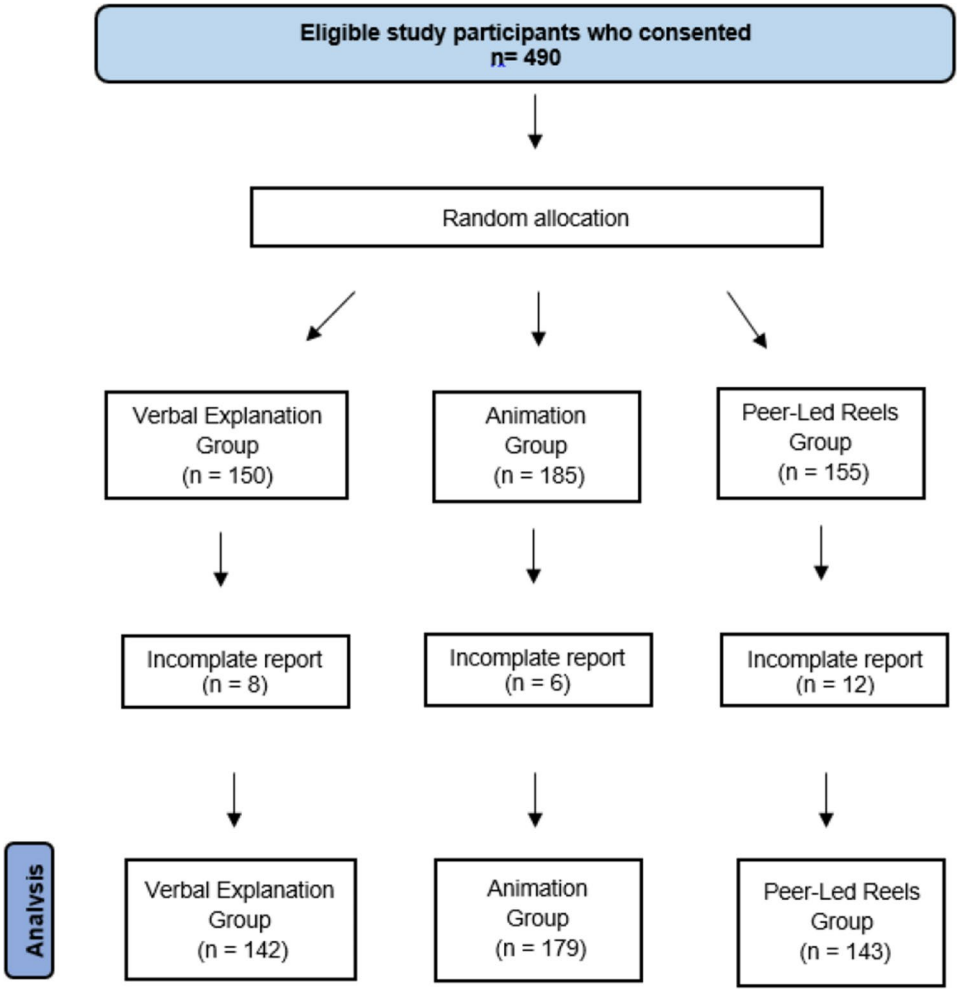


Fig. 1 Study diagram

conveyed oral hygiene information through both voice narration and text content.

In the peer-led reels group, oral hygiene information was presented for 1 min through a video created on the Instagram platform. The video was played once via Windows Media Player. The video depicted a child of a similar age to the target audience receiving oral hygiene information, followed by the child demonstrating the behavior, with background music. The video included some text, but did not feature the child's voice or information.

The education given in all three intervention groups was prepared in a way to match the questionnaire questions one-to-one. All educational methods included the same information about general oral hygiene. Following the education, the children completed the same questionnaire again. The knowledge acquired pre- and post-education was evaluated according to the three intervention groups, gender and tablet/mobile phone use.

Statistical analysis

Data analysis was conducted using the IBM Statistical Package for the Social Sciences (SPSS for Windows, version 26.0, SPSS Inc., Chicago, IL, USA). Descriptive statistics including number and percentage for categorical data and mean and standard deviation for continuous data were calculated. The normality of the data was assessed using the Kolmogorov-Smirnov test. The Wilcoxon test was used to compare the knowledge levels before and after oral hygiene education, while the analysis of covariance (ANCOVA) was used to evaluate the effects of group, gender, and tablet/mobile phone usage on the knowledge level at the end of the oral hygiene education. A p-value of <0.05 was considered statistically significant in all tests.

Results

This study was completed with 464 children, achieving a power (1-beta) of 89%. Initially, 490 children who completed the baseline questionnaire were included in the study. However, due to incomplete participant information in the follow-up questionnaires, a total of 464 children were included in the final analysis (Fig. 1).

Of the 464 children, 245 (52.80%) were girls and 219 (47.20%) were boys. Their mean age was 11.14 ± 0.49 and with ages ranging from 10.00 to 11.99 years. Among them, 400 (86.20%) reported using a tablet/mobile phone, while 64 (13.80%) reported not using one. In this study, where knowledge scores ranged from 0 to 8, the median knowledge scores in the verbal explanation group were 4 before the training and 7 after the training, with a statistically significant difference ($p<0.001$). In the animation group, it was 5 before the education and 7 after the education, with a statistically significant difference between them ($p<0.001$). In the peer-led reels group, it was 4 before the education and 6 after the education, with a statistically significant difference between them ($p<0.001$) (Table 2).

Pre-existing knowledge of oral hygiene among studentscould potentially act as a confounding factor. Therefore, after controlling for covariates related to pre-existing knowledge, the post-education knowledge levels were evaluated. The results of the analysis of covariance (ANCOVA) are presented in Table 3, which shows the main effects and interactions of the independent variables (group, gender, tablet or mobile phone use) on post-education knowledge level, while controlling for pre-education knowledge levels. The main effect of group was statistically significant, affecting post-education knowledge level by 3.8% (partial eta squared = 0.038). However, the main effects of gender and tablet or mobile phone use, as well as their interactions with group, respectively, were not statistically significant ($p=0.694$, $p=0.641$). Overall, group, gender, and tablet or mobile phone use explained 28% of the variance in post-education knowledge level.

The post-education knowledge levels of in the verbal explanation and animation groups were similar, whereas the knowledge levels of the peer-led reels group were significantly lower compared to the verbal explanation and animation groups ($p<0.001$). The highest post-education knowledge levels were observed in the animation group (6.73) followed by the verbal explanation group (6.57), with the lowest levels were found in the peer-led reels group (5.95) ($p<0.001$) (Table 4).

Table 2 The results of the general knowledge on oral hygiene before and after education by groups

Group	Before education		After education		*r*	Test Statistic	Sig.*
	Mean (sd)	Median (min-max)	Mean (sd)	Median (min-max)			
Verbal Explanation	4.06 (1.57)	4 (1–8)	6.57 (1.63)	7 (1–8)	0.26	9.17	**<0.001**
Animation	4.78 (1.91)	5 (0–8)	6.73 (1.54)	7 (0–8)	0.45	10.03	**<0.001**
Peer-Led Reels	4.31 (1.90)	4 (0–8)	5.95 (1.86)	6 (0–8)	0.66	8.93	**<0.001**
Total	4.42 (1.83)	4 (0–8)	6.44 (1.70)	7 (0–8)	0.46	16.17	**<0.001**

† Wilcoxon test

‡ The scoring: 0–8 with 0 being the lowest level of knowledge and 8 being the highest level of knowledge

§ Abbreviations: sd: standart deviation; min: minimum; max: maximum; r:correlation coefficient; sig: significant

Table 3 The ANCOVA analysis of the after education knowledge scores

	Type III Sum of Squares	df	Mean square	F	Sig.	Partial Eta Squared
Group	36.77	2.00	18.39	8.83	**< 0.001**	0.038
Gender	0.32	1.00	0.32	0.15	0.694	0.000
Tablet or Mobile phone use	0.45	1.00	0.45	0.22	0.641	0.000
Group* Gender	6.09	2.00	3.04	1.46	0.233	0.006
Group * Tablet or Mobile phone use	5.51	2.00	2.75	1.32	0.268	0.006
Gender * Tablet or Mobile phone use	0.28	1.00	0.28	0.13	0.714	0.000
Group * Gender * Tablet or Mobile phone use	4.00	2.00	2.00	0.96	0.384	0.004

† R squared = 0.298 (adjusted R squared = 0.280)

‡ Abbreviations: df: degree of freedom; F: ANCOVA test statistic; sig: significant

Table 4 Descriptive statistics of group, gender and tablet or mobile use on after education knowledge levels

Gender	Tablet or Mobile phone use	Group			Total
		Verbal Explanation	Animation	Peer-Led Reels	
Female	No	6.50 ± 1.78	7.00 ± 1.21	5.25 ± 1.67	6.38 ± 1.66
	Yes	6.58 ± 1.65	7.08 ± 1.10	6.20 ± 1.52	6.69 ± 1.44
	Total	6.57 ± 1.66	7.07 ± 1.10	6.09 ± 1.55	6.64 ± 1.47
Male	No	7.00 ± 1.36	6.67 ± 1.15	4.93 ± 1.98	6.00 ± 1.92
	Yes	6.46 ± 1.67	6.26 ± 1.93	6.05 ± 2.08	6.25 ± 1.91
	Total	6.57 ± 1.61	6.28 ± 1.90	5.83 ± 2.09	6.21 ± 1.90
Total	No	6.77 ± 1.56	6.93 ± 1.16	5.04 ± 1.85	6.19 ± 1.79
	Yes	6.53 ± 1.65	6.71 ± 1.57	6.13 ± 1.81	6.48 ± 1.68
	Total	6.57 ± 1.63[a]	6.73 ± 1.54[a]	5.95 ± 1.86[b]	6.44 ± 1.70

† [a, b] there is no differences between groups with the same letter (Bonferroni test)

‡ The scoring: 0–8 with 0 being the lowest level of knowledge and 8 being the highest level of knowledge

Discussion

In our study, we aimed to combine the benefits of peer influence and the accessibility of educational videos via social media to enhance children's knowledge on oral hygiene. To achieve this, a peer-led reels video was created. This study, which examines the effectiveness of a peer-led reels video in improving children's knowledge of oral hygiene compared to traditional education methods involving animated videos and verbal explanations with dental models, is the first of its kind in this field. This study resulted in a model that can explains 28% of the variance in post-education knowledge acquired through different educational methods, gender, and tablet/mobile phone usage.

There is no consensus on when children should be given oral hygiene education. Some researchers suggest that this should begin with parental education and parental guidance at birth [5, 21], while others recommend the school age [22]. In this study, children were directed to questions about oral hygiene and they answered these questions themselves at school. According to the latest issue of the Turkish Oral and Dental Health Research Report, the most common reason for visiting a dentist in our country is due to a dental problem with a rate of 90.4%, and when analysed by age, the age of the first visit to the dentist is most common (22.4%) around the age of 10 years [23]. At the same time, this age-group was selected as their development would enable them to understand cause-and-effect relationships and use logic to answer the questions, which is consistent with previous research [4, 24].

For a long time, lectures delivered by teachers in classrooms have been the most common form of teaching and learning. The main advantage of this method is the direct interaction between the teacher and students, which allows for feedback through eye contact during the lesson [1]. However, students process information in different ways, and as a result, various educational approaches such as verbal, written, visual, and auditory methods are effective in supporting learning. Given the diversity in learning styles, it is well-established that various educational methods can play a role in oral and dental health education programs, and that a single health education approach is unlikely to be suitable for all students [25]. With the advancement of technology and the increasing prevalence of children using technological devices, there is a need to integrate new methods for delivering oral health education [26]. Therefore, a main point of our study, traditional dental model verbal explanations were compared to animation videos and peer-led reels video methods for providing oral hygiene education. In addition, another main point of our study is to observe the effect of this verbal explanations and other educational methods, especially in children who are not exposed to technological devices such as tablet/mobile phone. According to the findings of our study, all three

educational methods were effective, with an increase in children's knowledge levels observed after the interventions. The limited knowledge of oral hygiene in children before the education and the increase in knowledge and awareness with education demonstrate the need for oral and dental health education programs in schools.

With the increasing accessibility of technological devices (such as tablets, mobile phones, and computers) and the rise in social media usage among children, changes are occurring in their learning perceptions [27]. Multimedia, which includes video and particularly cartoon animation, is extensively researched as an instructional aid [28]. The colorful characters and animated stories increase children's focus on education, making the conveyed messages more interesting and entertaining [12]. Additionally, these contents provide a standard level of education and can be repeated in the same format according to the viewers' needs. Therefore, it is possible to prevent knowledge discrepancies that may arise in education given at different times or through different experts using traditional methods [29]. Peer leaders are also mentioned in the literature as an alternative to experts in transferring knowledge. The effectiveness of this method is supported by social learning theories that propose that sensitive information is more easily shared among peers of similar age [13]. However, there is no consensus in the literature regarding the roles of these methods in oral and dental health education.

In studies comparing traditional and animation-based methods, Alhayek et al. [17] state that both methods are applicable, while Sinor [18], concludes that the animation environment is more effective and sustainable in providing oral health education. In their study, Gavic et al. [4] found that there was no statistically significant difference in the knowledge acquired by children through traditional methods and videos. However, after the education conducted through brochures, they found that children had a lower level of knowledge, but all three educational methods were effective. Yeo et al. [3] who investigated the effect of peer-led videos on oral hygiene, stated that it was effective in improving the overall oral hygiene knowledge of third-grade students. In our study, in addition to traditional methods and animation, peer-led reels videos, which have not been previously examined in the literature, were included. The effect of educational methods on knowledge level after education was observed to be 3.8%, while there was no effect of gender and tablet/mobile phone use on knowledge level. The effect of gender and tablet use on the level of knowledge after education was not observed. This situation is associated with the progress of education in our society, independent of gender characteristics, and the high probability of children being exposed to tablets/mobile phones in today's conditions, even if they do not own them.

In our study, children who received education through animated videos had the highest level of knowledge after the education, while similar results were found in children who received education through traditional methods. Additionally, peer-led education with reels videos resulted in lower knowledge acquisition compared to other methods. This finding provides evidence that the attractiveness of animations to children leads to an increased focus on the information provided by the animation [26].

Furthermore, it is believed that the traditional method of education, which is familiar to children who are accustomed to didactic education provided by teachers in classrooms, contributes to higher learning. Although it has been suggested that peer-led education is equally or more effective than that provided by teachers [14], our study indicates that the lower knowledge acquisition observed in the peer-led reels video may be attributed to its lack of audio, as it appeals solely to the visual sense, in contrast to other methods that engage both visual and auditory senses. Additionally, this silent video was only played once for the children, which means that there is a possibility that some information may have been conveyed too quickly, without allowing the children to focus or make meaningful connections.

Our study is characterized by the evaluation of the effectiveness of three different educational methods, including the first-time application of peer-led reels videos, and the implementation of these methods on students with varying characteristics in different schools, which constitutes the strength of our study.

The first limitation of the study is that it was conducted in only one region in Turkey. Secondly, the effect of the voice of the educator in the animation video between genders could not be evaluated.

In this study, gender, tablet/mobile phone use and three different educational methods (verbal lecture, animation video and peer-led reels video) were able to clarify 28% of the issue of improving children's oral hygiene knowledge. There is a need to clarify the 72% part that has not yet been resolved by evaluating personal demographic data and different educational methods that may affect knowledge gains in future studies. In our study, it was observed that learning with audio and visual stimuli was more significant. Based on this, we believe that it would be useful to evaluate the learning curves of children with tools such as virtual reality that appeal to more than one sense. Also as in other health education fields, there is a problem with retaining and applying knowledge in oral hygiene education. Therefore, there is a need for new studies that reach broader audiences nationwide, which follow up on the application of practices in children after gaining knowledge.

Conclusions

In oral hygiene education, it has been observed that traditional methods, animations and peer-led reels videos are effective in providing children with relevant information about oral hygiene. With the technological revolution making information more accessible and consumable for the new generation, we believe that animation videos may be more favorable today.

Supplementary Information

The online version contains supplementary material available at https://doi.org/10.1186/s12903-025-05493-6.

Supplementary Material 1

Supplementary Material 2

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Not applicable.

Author contributions
All authors contributed to the study concept and design. Material preparation, data collection and data analysis were performed by CBN, AC, NDŞ and HA. The first draft of the article was written by CBN and all authors contributed to the evaluation of the article. The final version of the article has been read and approved by all authors.

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Data availability
The data that support the findings of this study are available from the corresponding author upon reasonable request.

Declarations

Ethics approval and consent to participate
The ethical compliance of the study was approved by the Tokat Gaziosmanpaşa University Clinical Research Ethics Committee (Approval No. 21-KAEK-275 and dated 30.12.2021). The informed consent was obtained verbally and in writing from the parents or legal guardians of all participants included in the study. The study was conducted in accordance with the Helsinki Declaration of Ethics for Medical Research Involving Human Subjects.

Consent for publication
Not applicable.

Competing interests
The authors declare no competing interests.

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