Exploring the relationship between technological leadership self-efficacy of primary school administrators and 21st century skills

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This study aims to investigate the relationship between primary school administrators' technological leadership self-efficacy and 21st century skills. Employing descriptive (survey) research method, the opinions of the primary school administrators working in the state primary schools in the districts of Konya were examined. The Education Administrators Technological Leadership Self-Efficacy Scale and the 21st Century Skills and Competences Scale Directed at Teaching Candidates were administered. In order to analyse the data collected in the study, in which 272 questionnaire responses were collected, arithmetic mean, standard deviation, percentage, t-test, one-way analysis of variance (ANOVA) and correlation test and Cohen's d test were performed. The results revealed that primary school administrators' perceptions of technological leadership self-efficacy turned out to be at adequate level. It was also seen that there was no significant difference in terms of technological leadership levels of administrators in line with gender and professional experience. It was seen that school administrators' consider 21st century skills important. The results also indicated that there was no significant difference between primary school administrators' perception of 21st century skills and gender, experience, and age. In addition, there is a significant difference between primary school administrators' perceptions of 21st century skills and the variables of position and educational status. The findings also showed that there is a positive, moderate, and significant relationship between the sum and dimensions of primary school administrators' technological leadership behaviours and the sum and dimensions of 21st century skills.

Introduction

In the 21st century, many fields go through constant change and development. It is surely beyond doubt that education systems are one of these areas. Considering that the practice areas of the education system are schools, school principals have a very crucial partin

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leading the change of schools (Gürkan & Toprakçı, 2018). As the future will be different from the present, schools should both shape the future and prepare students for it. For schools to achieve this, they need to know the qualities that individuals should have in the future and perform the essential structural reforms (Yılmaz et al., 2016). The leadership skills of school principals who lead schools are of great importance in the development and transformation of schools. For this reason, it is very difficult to reach the planned goals without a visionary school principal (Çalmaşur et al., 2015). In that sense, school principals should follow new developments in education and management and constantly question their own professional competence (Karen Miller, 2018). To the extent that school principals employ their leadership skills, they can realize the expected change (Olea, 2020).

Change starts within the classroom and ends in the classroom. In short, the application area of the change that will take place is classrooms. Therefore, teachers need collaborative and professional learning environments to realize the intended curriculum. The person to prepare these learning environments is the school principal (Fullan, 2008). In that regard, school principals can be effective to the extent that they have theoretical and conceptual knowledge and communication skills (Peker & Selçuk, 2011). The knowledge and skills of school principals have a great influence on teachers. Furthermore, the leadership skills of the school principal influence the teachers' commitment to the school, their motivation, their perspective on the profession, andthus student success (Aydın & Sarıer, 2013). Students, teachers, and educational administrators are expected to keep up with the changing times. In this regard, it is obvious that school administrators who are in leading positions should have the necessary competencies (Yılmaz, 2021).

The fact that there is no criterion for technological competencies and 21st century skills in appointing administrators in Turkey and the inadequacy of in-service training provided to the administrators raises the question of the technological competence of the school administrators. Considering that individuals with 21st century skills will be successful individuals who can adapt to this century, it is unthinkable that school administrators do not have these skills. The concept of technological leadership should be well-understood and practiced properly for school administrators to keep up with the changing and developing times. In addition, teachers who keep up with the 21st century will only be possible with school administrators who lead them in this regard. Considering all these, this study examined the relationship between primary school administrators' perceptions of technological leadership self-efficacy and 21st century skill perceptions. It is important to scrutinize the level of technological leadership self-efficacy and 21st century skill perceptions of school administrators to be aware of the current situation and make future adjustments. It is thought that the inclusion of variables that may have an effect and relationship in the examination of technological leadership and 21st century skills will contribute to the comprehensive examination and understanding of the issue. For this reason, variables of gender, position, level of education, experience, and age, which may have significant relationships, were also incorporated in the study.

Purpose of the study

In light of the literature review, it can be said that there is an array of studies concentrating on the concepts of technological leadership and 21st century skills. However, to the researchers' best knowledge, no study particularly based on managers' views on the relationship between these concepts has been found. To that end, the current study is likely to make a contribution to the current literature and fill a gap in the field through the results

reached. Thus, the study aims to uncover the relationship between school managers' perceptions of technological leadership self-efficacy and 21st century skills. To this end, the following research questions were addressed:

(1) What are the levels of technological leadership self-efficacy perceptions of primary school administrators? Do they differ in terms of gender, position, education level, experience, and age?
(2) How do primary school perceive their 21st century skills? Do they differ in terms of gender, position, education level, experience, and age?
(3) Is there a significant relationship between primary school administrators' technological leadership self-efficacy and 21st century skills?

Method

The present study, exploring the effect of primary school administrators' technological leadership self-efficacy on 21stcentury skills, is designed as Descriptive (Survey) Research which is one of the quantitative research designs. In this study, descriptive research method was used to reveal the current situation regarding primary school administrators. This study focuses on analysing and interpreting the technology leadership and 21st century skills of primary school administrators. In descriptive research, phenomena that continue to exist are scrutinized and discussed and the researcher attempts to portray the cases as they are without any intervention (Sönmez & Alacapınar, 2019).Descriptive research is not concerned with an explanation of the cause of reality. Objectivity and impartiality are at the forefront (Lans & Woordt, 2002).

Participants

A full count study was conducted with a total of 465 administrators, namely 183 school principals and 282 vice principals, working in state primary schools in the city center of Konya (i.e., Karatay, Meram, and Selçuklu) in the 2021-2022 academic year. 91 school principals and 181 vice principals participated in the survey on a voluntary basis. Investigation of the entire research population is called consensus. The populations to be examined by the consensus method are oftentimes small. Moreover, this method is advantageous in that it is free from complex procedures and rules and gives an idea about the nature and size of the population (Ergin, 1991). The demographics of the participants are illustrated in Table 1.

Table 1. The participants

Variable	Group	n	%
Gender	Female	54	19,9
	Male	218	80,1
Degree	Associate/Bachelor	179	65,8
	Graduate/Doctorate	93	34,2
Age	20-30	10	3,7
	31-40	125	46
	41-50	92	33,8
	51 and above	45	16,5
Experience	1-5 Years	7	2,6
	6-10 Years	26	9,6
	11-15 Years	81	29,8
	16-20 Years	63	23,2
	21 and above	95	34,9
Position	Principal	91	33,5
	Vice Principal	181	66,5
	Total	**272**	**100**

Males made up 80.1% of the participants in the current study (see table 1). Considering the educational status of the participants, 34.2% of them had a postgraduate degree. 46% of the participants are between the ages of 31-40, and 33.8% are between the ages of 41-50. As far as the experience of the participants is concerned, 34.9% of the participants have 21 years of experience and above, 29.8% have 11-15 years of experience, and 23.2% have 16-20 years of experience. Finally, 33.5% of the participants are school principals, while 66.5% are vice principals.

Data collection tool

Adopted by Hacıfazlıoglu et al. (2010), Educational Administrators' Technological Leadership Self-Efficacy Scale (EATLSES) is based on ISTE's NETS-A Standards and consists of 5 sub-dimensions and 21 items comprised of visionary leadership, digital age learning culture, perfection in professional application, systematic improvement, and digital citizenship with no reverse item in the five-point scale. A Confirmatory Factor Analysis (CFA) was performed so as to check the validity of the scale, and the construct validity of the scale was found to be sufficient. The original coefficient of Cronbach Alpha of the scale was found to be .97. Furthermore, the 21st Century Skills and Competences Scale Directed at Teaching Candidates developed by Anagün, Atalay, Kılıç, and Şahin (2016) was used to reveal the perceptions of the 21st century skills of primary school principals. Three factors that emerged as a result of the exploratory factor analysis were identified as follows:

(1) learning and innovation skills,
(2) life and career skills and information,
(3) media, and technology skills.

Data analysis

In this study, mean, mode, and median values were calculated to explore the data gathered from the administrators to reveal the relationship between primary school principals' technological leadership perceptions and 21st-century skills. The arithmetic means, median (median), and peak values (mode) of the scale data are equal in a normal distribution. In addition, the normality test was performed to check if the scale data were normally distributed. The data pertaining to the normality test are shown in Table 2.

Table 2. Normality test results of the Technological Leadership Scale and the 21st Century Skills Scale

Variables	Factors	X̄	Mode	Median	Skewness	Kurtosis
Technological Leadership		100,70	104	103	-,98	1,60
21st Century Skills		174,77	165	175	-,29	-,18
Technological Leadership	Visionary Leadership	15,32	16	16	-,87	1,43
	Digital Age Learning Culture	23,39	24	24	-,80	1,04
	Perfection in Professional Application	19,72	20	20	-,84	1,14
	Systematic Improvement	22,80	24	24	-,85	1,16
	Digital Citizenship	19,47	20	20	-,69	,55
21st Century Skills	Learning and Innovation Skills	65,77	64	65	,02	-,62
	Life and Career Skills	74,80	70	75	-,46	-,07
	Information, Media, and Technological Skills	34,20	32	34	-,32	-,60

Findings

Statistical values related to primary school principals' 21st century skills and technological leadership are given in Table 3.

Table 3. Primary school principals' 21st century skills and technological leadership levels

Variables	Factors	N	X̄	Ss	Lowest Variables	Highest Variables
Technological Leadership		272	3,87	17,80	32	130
21st Century Skills		272	4,16	17,06	126	206
Technological Leadership	Visionary Leadership	272	3,82	2,95	4	20
	Digital age Learning Culture	272	3,89	4,35	7	30
	Perfection in Professional Application	272	3,94	3,54	7	25
	Systematic Improvement	272	3,79	4,48	6	30
	Digital Citizenship	272	3,90	3,75	7	25
21st Century Skills	Learning and Innovation Skills	272	4,15	7,68	48	80
	Life and Career Skills	272	4,19	7,23	54	88
	Information, Media, and Technology Skills	272	4,33	4,11	24	40

The lowest score of technological leadership scores of primary school administrators was calculated as 32 and the highest was 130 points, and the mean score was found to be 100.70.

In addition, the 21st century skills mean score of primary school administrators is 174.77; the lowest score turned out to be 126, whereas the highest score was 206.

Findings related to the first research question

The first research question explored if there was a significant difference between the level of technological leadership self-efficacy perceptions of primary school principals and their gender, position, education level, experience and age.

The results of the independent samples t-tests revealed that there is no significant difference in terms of the gender variable of primary school administrators and the means of technological leadership and its sub-dimensions ($p>.05$). Furhermore, technological leadership mean scores of female managers turned out to be close to the ones of male managers.

Table 4. Independent t-test results conducted to determine the significance of the technological leadership and sub-dimensions scores of primary school administrators in terms of position

Variable	Position	N	X̄	SS	Levene's (F;p)	t	p	Cohen's d
Technological Leadership	Principal	91	4,04	15,12	1,28			
	Vice Principal	181	3,78	18,65	p>.05	2,91	,004	,38
Visionary Leadership	Principal	91	4,07	2,66	,56			
	Vice Principal	181	3,70	2,96	p>.05	3,95	,000	,51
Digital Age Learning Culture	Principal	91	4,05	3,76	,50			
	Vice Principal	181	3,81	4,54	p>.05	2,61	,009	,34
Perfection in Professional Application	Principal	91	4,10	3,13	,56			
	Vice Principal	181	3,86	3,68	p>.05	2,60	,010	,34
Systematic Improvement	Principal	91	3,96	3,87	1,93			
	Vice Principal	181	3,70	4,69	p>.05	2,55	,011	,33
Digital Citizenship	Principal	91	4,02	3,31	1,70			
	Vice Principal	181	3,83	3,90	p>.05	2,18	,030	,28

* *p< 0.05*

The variable of position of primary school principals and the mean scores of technological leadership and all its sub-dimensions yielded a significant difference ($p<.05$). Technological leadership mean scores of school principals are significantly higher than the mean scores of vice principals. To this end, it can be said that the effect size is moderate according to Cohen's d value calculated to find the effect of the primary school administrators' position on technological leadership.

Tablo 5. Independent t-test results conducted to determine the significance of technological leadership and its sub-dimensions scores in relation to primary school administrators' educational status

Variable	Education	N	$\bar{X}$	SS	Levene's (F;p)	t	p	Cohen's d
Technological Leadership	Bachelor's	179	3,74	18,91	5,33	-4,28	,00	-,57
	Master's	93	4,11	13,46	p<.05			
Visionary Leadership	Bachelor's	179	3,70	3,15	6,99	-4,27	,00	-,51
	Master's	93	4,06	2,23	p>.05			
Digital Age Learning Culture	Bachelor's	179	3,77	4,60	4,29	-3,85	,00	-,51
	Master's	93	4,12	3,43	p<.05			
Perfection in Professional Application	Bachelor's	179	3,81	3,72	2,80	-4,60	,00	-,56
	Master's	93	4,18	2,81	p>.05			
Systematic Improvement	Bachelor's	179	3,67	4,70	4,03	-4,34	,00	-,57
	Master's	93	4,03	3,54	p<.05			
Digital Citizenship	Bachelor's	179	3,78	3,97	5,33	-3,56	,00	-,47
	Master's	93	4,11	2,99	p<.05			

* *p*< 0.05

There came out a significant difference between the educational status variable of primary school administrators and the means of technological leadership and its sub-dimensions (*p*<.05). Technological leadership and sub-dimension mean scores of primary school administrators with a master's degree are significantly higher than those with a bachelor's degree. It can be said that the effect size is moderate according to Cohen's d value calculated to find the level of effect of primary school administrators' educational status on the technological leadership dimension.

The results of the ANOVA performed to investigate whether there is a significant difference in the scores of technological leadership and sub-dimension levels in terms of experience indicated that the mean scores of technological leadership and sub-dimensions of primary school administrators do not differ statistically in relation to the variable of experience.

Table 6. The results of analysis of variance (ANOVA) to examine whether there is a significant difference in the scores of technological leadership and its sub-dimensions levels in terms of age

FACTOR	GROUPS	n	X̄	SS	F	p	Welch p	Difference
Technological Leadership	20-30	7	4,18	12,79	5,49	,001	,023	1-4 2-4 3-4
	31-40	26	3,90	14,03				
	41-50	81	3,96	17,50				
	51+	63	3,52	24,81				
Visionary Leadership	20-30	7	4,07	10,91	1,39	,238	,240	------
	31-40	26	3,85	16,19				
	41-50	81	3,91	14,78				
	51+	63	3,52	14,83				
Digital Age Learning Culture	20-30	7	3,94	3,86	5,80	,006	,087	------
	31-40	26	3,95	3,57				
	41-50	81	3,98	4,20				
	51+	63	3,55	5,95				
Perfection in Professional Application	20-30	7	4,28	10,91	1,39	,238	,240	------
	31-40	26	3,95	16,19				
	41-50	81	4,05	14,78				
	51+	63	3,61	14,83				
Systematic Improvement	20-30	7	4,30	3,89	5,95	,001	,016	1-4 3-4
	31-40	26	3,82	3,67				
	41-50	81	3,87	4,28				
	51+	63	3,43	6,07				
Digital Citizenship	20-30	7	4,42	2,53	4,69	,001	,003	1-4
	31-40	26	3,95	3,16				
	41-50	81	3,96	3,66				
	51+	63	3,51	4,87				

* $p< 0.05$

The results of the ANOVA to explore if there is a significant difference in the scores of technological leadership and its sub-dimensions in terms of age revealed a significant difference between the technological leadership mean scores of primary school principals and the age variable. While there is no significant difference between the sub-dimensions of visionary leadership, digital age learning culture, and perfection in professional application in relation to the age variable, it is seen that there is a significant difference between systematic improvement and digital citizenship sub-dimensions. The technological leadership scores of primary school principals aged 51 and above differ significantly from the scores of primary school administrators aged 20-30, 31-40, and 41-50. The scores of primary school administrators in relation to perfection in professional application aged 51 and above differ significantly from the scores of primary school administrators aged 20-30 and 41-50. The systematic improvement scores of primary school administrators aged 51 and above differ significantly from the scores of primary school administrators aged 20-30 and 41-50.

Findings pertaining to the second research question

There came out a significant difference between the 21st century skills self-efficacy perception levels of primary school principals and their gender, duty, education level, seniority, and age.

The results of the independent t-tests unearthed that there is no significant difference in the mean scores of 21st century skills and sub-dimensions of the participants in terms of the gender variable (*p*>.05). The mean scores of 21st century skills of female managers turned out to be close to the those of male managers.

Table 7. Independent t-test results performed to investigate the significance of 21st century skills and sub-dimension scores in terms of the variable of the position of primary school administrators

Variable	Position	N	X̄	SS	Levene's (F;p)	t	p	Cohen's d
21st Century Skills	Principal	91	4,28	16,02	,45 p>.05	3,47	,001	,45
	Vice Principal	181	4,10	17,06				
Learning and Innovation Skills	Principal	91	4,25	7,42	,18 p>.05	3,62	,000	,46
	Vice Principal	181	4,04	7,55				
Life and Career Skills	Principal	91	4,27	6,60	,92 p>.05	3,39	,001	,44
	Vice Principal	181	4,09	7,32				
Information, Media, and Technology Skills	Principal	91	4,34	4,07	,001 p>.05	1,64	,100	,21
	Vice Principal	181	4,24	4,11				

There is a significant difference in terms of the variable of the position of primary school principals and their 21st century skills (*p*<.05). While there was a significant difference in terms of the position variable for learning and innovation skills, life and career skills, no significant difference was detectedregarding information, media, and technology skills.

School principals' 21st century skills mean scores are significantly higher than vice principals' mean scores. It can be said that the effect size is moderate according to Cohen's d value calculated to find the effect of the primary school administrators' position on the 21st century skills.

Table 8. Independent t-test results conducted to determine the significance of 21st century skills and sub-dimension scores in terms of primary school administrators' educational status

Variable	Education	N	X̄	SS	Levene's (F;p)	t	p	Cohen's d
21st Century Skills	Bachelor's	179	4,09	17,78	4,03 p<.05	-4,08	,000	-,50
	Master's	93	4,28	14,21				
Learning and Innovation Skills	Bachelor's	179	4,05	7,78	,66 p>.05	-3,40	,001	-,42
	Master's	93	4,24	7,05				
Life and Career Skills	Bachelor's	179	4,08	7,64	7,06 p<.05	-,3,80	,000	-,50
	Master's	93	4,28	5,75				
Information, Media, and Technological Skills	Bachelor's	179	4,21	4,36	7,76 p<.05	-2,87	,004	-,38
	Master's	93	4,39	3,38				

* p< 0.05

There is a significant difference between primary school administrators' educational status variable and 21st century skills and sub-dimension mean scores (p<.05). The mean scores of 21st century skills of primary school administrators with a master's degree are significantly higher than the mean scores of primary school administrators with a bachelor's degree. It can be said that the effect size is moderate according to the Cohen's d value calculated to find the size of the effect of primary school administrators' educational status on 21st century skills.

The variance (ANOVA) analysis results to explore whether there is a significant difference in the scores of 21st century skills and sub-dimensions levels in terms of experience, showed that the 21st century skills and sub-dimension point averages of primary school administrators did not differ statistically in terms of experience.

In addition, the results of the variance (ANOVA) analysis to investigate whether there is a significant difference in the scores of 21st century skills and sub-dimensions levels in terms of age revealed that the 21st century skills and sub-dimension point averages of primary school principals did not differ statistically regarding the age variable.

Findings Regarding the Third Research Question

The relationship between the technological leadership levels and sub-dimensions of primary school principals and the level of 21st century skills was examined using the Pearson Product Moments Correlation Coefficient Technique. A positive moderately significant relationship was found between primary school administrators' perceptions of technological leadership and perceptions of 21st century skills (p<0.01; r=.631). The technological leadership dimension scores of primary school principals and 21st century skills sub-dimensions learning and innovation skills (p<0.01; r=.578), life and career skills (p<0.01; r=.549) and information, media and technology skills (p<0.01; r=.574), a moderately significant positive relationship was also found between them. There was also a positive moderately significant relationship between primary school administrators' 21st century skills and five sub-dimensions of technological leadership; visionary leadership (p<0.01; r=.602), digital age learning culture (p<0.01; r=.602), perfection in professional application (p<0.01; r=.575), systematic improvement (p<0.01; r=.588) and digital citizenship (p<0.01; r=.581).

Discussion and Conclusion

The current study's findings revealed that the technological leadershipperceptions of principals working at primary schools were at the adequate level.In this case, it can be thought that primary school administrators see themselves as technological leaders.It is seen that this result echoes the results of previous research on the subject in the literature. Similarly, Gün and Çoban (2019) also found that school administrators' technological leadership self-efficacy is at a sufficient level in their study. Ulukaya (2015), Seven (2021), Görgülü and Küçükali (2013) and Gültekin (2013) concluded that primary school administrators' technology leadership self-efficacy does not differ by gender. It was found that there is a significant difference between the technological leadership behavior perceptions of school administrators and their position in the school. Görgülü et al. (2013), Düzgün (2022) and Sağbaş (2019) also revealed that there is a significant difference between the position variable of managers and their perceptions of technological leadership competence. It was also seen that school administrators' perceptions about technological leadership behaviors are significant in relation to their educational status. Similarly, Düzgün (2022) revealed that the technological self-efficacy of school administrators varies in line with their educational status. It was also discovered that primary school administrators' perceptions of technological leadership do not

differ in terms of experience. Gültekin (2013), Görgülü and Küçükali (2013), Sağbaş (2019) and Seven (2021) concluded in their study that they could not find a significant relationship between the technological leadership self-efficacy of school administrators and their professional experience. Moreover, it was seen that there is a significant relationship between school administrators' technological leadership behavior perceptions and their ages. Düzgün (2022) and Gün and Çoban (2019) also found that there is a significant relationship in terms of the age of school administrators and their perceptions of technological leadership.

The results also revealed that the perceptions of the 21st century skills level of the primary school principals were at the level of often. Güçlü and Kuuk (2019) and Elekoğlu and Demirdağ (2020) similarly found in their research that school principals have a high level of 21st century skills. It is observed that primary school administrators' perceptions of 21st century skills do not differ by gender. Cemaloğlu et al. (2019) revealed that there is no significant difference between the gender of school administrators and their self-efficacy perceptions of 21st century skills. It is seen that school administrators' perceptions of 21st century skills behaviors differ significantly by position in the school. Unlike his new (2020) research, it has been revealed that there is no significant difference between the views of vice principals and the views of school principals in terms of 21st century skills. It is seen that school administrators' perceptions of 21st century skills behaviors differ significantly in terms of their educational status. Yörük (2021) also found that there is a significant difference between the education levels of school administrators and their 21st century skills behaviors based on the opinions of teachers. It is found that primary school principals' perceptions of 21st century skills do not differ by professional experience. Elekoğlu (2020), Toptimur (2021), Tülgen (2021) and Yörük (2021) also revealed in their studies that teachers' views on 21st century skills competencies ofschool administrators do not differ significantly in terms of professional seniority. It is seen that primary school administrators' perceptions of 21st century skills do not differ by age. Similarly, Toptimur (2021) did not find a significant difference between teachers' perceptions of 21st century skills competence and their ages.

According to the results of the present study, a significant, positive, and moderate relationship was found between primary school principals' technological leadership and the level of 21st century skills. Similarly, in the study by Tülgen (2021), it was found there is a moderate, positive and significant relationship between the dimensions and sub-aspects of 21st century skills and the dimension and sub-dimensions of technology leadership behaviors.

In conclusion; detailed inferences can be made based on the relationship between primary school administrators' technological leadership level and 21st century skills levels.In the context of the findings obtained in this research, it can be said that primary school administrators create a vision about technology in their schools, encourage the use of technology in the teaching process and follow the technological developments of the stakeholders.It is possible to say that primary school administrators are individuals who have developed themselves personally and socially, have research and knowledge acquisition skills, and are creative and innovative individuals who make a difference.This situation is expected to increase the quality of education in the country.

Recommendations

According to the results of the research, since the technological leadership and 21st century skills competencies of the managers who received graduate education are significantly different from those who have undergraduate education, managers should be

encouraged to take graduate education.In the evaluation form used in the reassignment process of senior school administrators, items related to technology use and 21st century skills can be found.Within the scope of this study, the opinions of school administrators were evaluated. More comprehensive studies could be carried out in different settings that will include the perspectives of teachers, students, and parents. It is also possible to work with managers working at different educational levels. In addition, the seniority of managers can be analyzed by separating them as management seniority and professional seniority in future studies. Future research on the issue might be conducted using mixed research or qualitative paradigm. The effect of the current pandemic process on the 21st century skills and technological leadership of school administrators can also be investigated. Collaboration between universities and schools might be beneficial for administrators and teachers to develop technological competence and 21st century skills.

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