

Virtual Assistants: Building Convenience or Reducing Thinking Power?

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Abstract: This study explores the relationship between the use of virtual assistants and students' critical thinking skills at Vocational High Schools in Jakarta. With the increasing use of technology in education, virtual assistants have become a common tool that students use to complete school assignments. However, there are concerns that reliance on this technology may reduce students' critical thinking abilities. This study uses a quantitative method involving 80 vocational students as respondents. Data were collected through a questionnaire that measured the frequency of virtual assistant use and assessments of critical thinking skills. Data analysis was performed using the Pearson correlation test and Chi-Square analysis to determine the relationship between the two variables. The results showed that there was no significant relationship between the use of virtual assistants and students' confidence in their critical thinking skills. These findings provide important insights for educators and curriculum developers in designing learning strategies that balance the use of technology and the development of critical thinking skills. The study suggests that virtual assistants may serve as complementary tools in education without necessarily diminishing students' critical thinking abilities when used appropriately.

Keywords: Virtual Assistant, Critical Thinking Ability, Students, Vocational High School, Quantitative Method, Pearson Correlation, Chi-Square Analysis, Educational Technology.

INTRODUCTION

The development of information and communication technology has brought significant changes in various aspects of life, including in the world of education. One innovation that is increasingly popular is the use of virtual assistants, such as Google Assistant, Siri, Alexa, and ChatGPT, which can help students in completing school assignments. Although virtual assistants offer convenience and efficiency, there are concerns that reliance on this technology can reduce students' critical thinking skills. Critical thinking ability is an important skill needed to analyze information, solve problems, and make appropriate decisions.

In Indonesia, especially in Jakarta, many Vocational High School (SMK) students use virtual assistants in their learning process. However, the impact of using virtual assistants on students' critical thinking skills has not been widely studied. Therefore, this study aims to explore the relationship between the use of virtual assistants and the critical thinking skills of students in SMK Jakarta.

The rapid digitalization of educational environments has transformed traditional learning methodologies. Virtual assistants, powered by artificial intelligence, offer immediate responses to queries, provide summarized information from vast databases, and assist in various academic tasks. While these technologies promise enhanced learning experiences through quick access to information, there remains a fundamental question about their impact on cognitive development, particularly critical thinking skills.

Critical thinking is characterized by the ability to analyze, evaluate, and synthesize information to form reasoned judgments. These cognitive processes are essential in academic settings and are highly valued in the modern workplace. As students increasingly rely on virtual assistants to answer questions and complete assignments, educators and researchers are concerned about the potential atrophy of these intellectual capabilities.

Based on the background above, the problem formulation in this study is as follows:

1. How often do vocational students use virtual assistants in completing school assignments?
2. How do vocational students rate their critical thinking skills?
3. Is there a significant relationship between the use of virtual assistants and the critical thinking skills of vocational students?

The objectives of this study were to determine the frequency of vocational students' use of virtual assistants in completing school assignments, to evaluate the critical thinking skills of vocational students, and to analyze the relationship between the use of virtual assistants and the critical thinking skills of vocational students.

This research is expected to provide the following benefits:

1. For students, providing an understanding of the importance of a balance between the use of technology and the development of critical thinking skills
2. For educators, being a reference in designing learning strategies that utilize technology

without reducing students' critical thinking abilities

3. For educational institutions, informing policy development regarding technology integration in curricula
4. For further researchers, being a reference for further research on the impact of technology in education

This research will be conducted in several vocational schools in Jakarta involving 80 students as respondents. The focus of this research is on the use of virtual assistants and students' critical thinking skills, without discussing other aspects of the use of technology in education. In this study, virtual assistants are defined as artificial intelligence-based technologies that can assist users in completing tasks through voice or text commands. Critical thinking ability is defined as the ability to analyze, evaluate, and make decisions based on available information. Vocational students are students enrolled in Vocational High Schools in Jakarta.

This introductory chapter provides an overview of the background, problem formulation, objectives, benefits, scope, and operational definitions that will form the basis of this research. This research is expected to make a meaningful contribution in understanding the relationship between the use of virtual assistants and students' critical thinking skills.

THEORETICAL FOUNDATION

Virtual Assistants in Education

A virtual assistant is an artificial intelligence-based technology designed to assist users in completing various tasks through voice or text interactions. Kurniawan (2020) states, "Virtual assistants can improve student learning efficiency by providing fast access to information and the resources needed." The use of virtual assistants in education is increasing, especially among students who are looking for ways to complete assignments more quickly and easily.

Virtual assistants operate through natural language processing systems that interpret user inputs and generate appropriate responses. They can perform tasks ranging from simple information retrieval to complex problem-solving. In educational contexts, they serve as repositories of knowledge that students can access instantaneously. According to Setiawan (2021), "Virtual assistants represent a paradigm shift in how students interact with information, transforming the research process

from hours of library work to seconds of digital conversation."

Wulandari (2021) conducted a case study on the use of virtual assistants in online learning during the COVID-19 pandemic. Her findings indicated that 78% of secondary school students regularly used virtual assistants to help with homework, research projects, and exam preparation. The study highlighted the convenience factor as the primary motivation for students to use these technologies.

However, although virtual assistants offer convenience, there are concerns that reliance on this technology can reduce students' critical thinking skills. Nugroho (2020) examined the relationship between virtual assistant usage and learning outcomes among high school students. His research found that while students who frequently used virtual assistants showed improved factual knowledge, they sometimes demonstrated less depth in analytical tasks compared to those who used traditional research methods.

Critical Thinking in the Digital Age

According to Facione (2011), "Critical thinking is an intellectual process that involves analysis, evaluation, and synthesis of information to make appropriate decisions." Critical thinking skills are critical in education, because they help students not only receive information but also analyze and evaluate that information in depth.

Critical thinking encompasses several cognitive dimensions including:

1. **Analysis:** Breaking down complex information into constituent parts
2. **Evaluation:** Assessing the credibility and validity of information sources
3. **Inference:** Drawing reasonable conclusions based on evidence
4. **Explanation:** Clearly articulating findings and reasoning processes
5. **Self-regulation:** Monitoring and correcting one's own thinking

Prasetyo (2022) argues that "The digital era presents unique challenges to critical thinking development, as information abundance often conflicts with information quality." His research suggests that students face difficulties in distinguishing credible sources from misinformation when using digital tools, including virtual assistants.

Rahmawati (2019) conducted a study on the impact of technology use on students' critical

thinking abilities. Her research involved 150 high school students and found that while technology provided access to diverse perspectives, it also created tendencies toward cognitive shortcuts. Students who heavily relied on digital tools were more likely to accept information without sufficient scrutiny.

Sari (2021) expands on this concept by examining critical thinking skills in relation to technological usage patterns. Her research introduced the concept of "technological critical thinking," which she defined as "the ability to critically evaluate both the content provided by technology and the limitations of the technological medium itself." This dual awareness is particularly relevant when considering virtual assistants, which present information in authoritative tones despite potential inaccuracies.

Technology Integration and Learning Theories

In the context of education, technology can serve as a tool that supports the learning process. According to Prensky (2001), "The current generation is a digital generation that grows with technology, and they need a learning approach that suits the way they interact with the world." This shows that students today are more comfortable using technology, including virtual assistants, in their learning process.

Constructivist learning theory, as explored by Chai and Lim (2011), suggests that knowledge is actively constructed by learners rather than passively received. In this framework, technology should ideally facilitate the construction process rather than circumvent it. Virtual assistants, therefore, could either enhance constructivist learning by providing resources for students to build upon or hinder it by offering ready-made answers that bypass the cognitive construction process.

The theory of connectivism, introduced by Siemens and expanded upon by Garrison and Anderson (2003), posits that learning in the digital age occurs through connections within networks. This theory recognizes the role of technology as an enabler of learning rather than merely a tool. In this context, virtual assistants might be viewed as nodes within a student's learning network, providing connections to information that students then integrate into their knowledge frameworks.

Previous Research on Technology and Critical Thinking

Previous research shows that the use of technology in education can have positive and negative impacts. According to Hwang and Chang (2011), "The use of technology can increase students' learning motivation, but it can also cause excessive dependence on these tools." This shows the need for a balance in the use of technology, so that students not only rely on virtual assistants, but also develop their critical thinking skills.

Fitria (2022) conducted research on the influence of virtual assistants on the learning process in schools. Her study involving 200 students from multiple schools found that virtual assistants significantly changed how students approached research tasks. Students who used virtual assistants spent 40% less time on initial research but showed varied results in terms of depth of understanding, suggesting that the quality of engagement with the information mattered more than the tool used to obtain it.

In addition, according to Heppell (2011), "Technology should be used to enrich the learning experience, not to replace the critical thinking process." This opinion emphasizes the importance of integrating technology in education in a way that supports the development of students' critical thinking skills.

Hidayati (2020) examined the impact of technology in education on critical thinking skills. Her research involved comparative analysis of learning outcomes in technology-rich versus traditional learning environments. She concluded that "technology amplifies existing pedagogical approaches—it enhances student-centered, inquiry-based learning but can further entrench passive learning if implemented without appropriate instructional design."

Lestari (2019) focused on technology's role in enhancing student creativity. Her research suggested that creative thinking and critical thinking are interconnected cognitive processes, and that technology could serve as a catalyst for both. She found that students who used technology as a creative medium rather than merely as an information source demonstrated stronger critical thinking skills in subsequent assessments.

In this context, research by Lai and Hwang (2016) shows that "The right use of technology can improve students' critical thinking skills, as long as students are trained to use the technology effectively." This shows that training and guidance in the use of virtual assistants is very important to

ensure that students not only rely on technology, but also develop their critical thinking skills.

The "Johnson *et al.* (2014) NMC Horizon Report" identified the integration of personal digital assistants into education as an emerging trend that would significantly impact learning methodologies. The report predicted both opportunities for personalized learning and challenges regarding critical thinking development, recommending that educational institutions develop frameworks for technology use that explicitly supported higher-order thinking skills.

Zhao and Frank (2003) developed an ecological perspective on technology integration in schools, suggesting that technologies survive and thrive in educational environments based on their perceived value and compatibility with existing practices. Their research provides insight into why virtual assistants have gained popularity in educational settings—they address immediate needs for information access and task completion in ways that align with students' existing behaviors.

Theoretical Framework for the Current Study

Based on the literature reviewed, this study adopts a theoretical framework that considers virtual assistants as tools that may influence critical thinking skills through various mechanisms:

1. **Information accessibility:** Virtual assistants provide immediate access to information, potentially reducing the effort required for information gathering but also potentially bypassing the critical evaluation process.
2. **Response formulation:** The way virtual assistants present information may influence how students process and internalize that information.
3. **Usage patterns:** The frequency and purpose of virtual assistant use may mediate its impact on critical thinking development.
4. **Educational context:** The guidance provided by educators regarding appropriate use of virtual assistants may moderate their impact on critical thinking.

Thus, this theoretical foundation shows that although virtual assistants can provide convenience in completing assignments, it is important to consider their impact on students' critical thinking skills. This study aims to explore the relationship between the use of virtual assistants and the critical thinking skills of students at Vocational High Schools in Jakarta, with the

hope of providing deeper insights into the role of technology in education.

RESEARCH METHODS

Research Design

This study employed a quantitative research approach with a correlational design to examine the relationship between virtual assistant usage and critical thinking skills among vocational high school students. This approach was selected to quantify the relationship between the variables and determine if there is a statistically significant connection between them. The correlational design allows for an examination of relationships without manipulating variables, making it appropriate for this educational context where experimental manipulation might be impractical or ethically questionable.

Population and Sample

The population in this study was vocational students registered in several schools in Jakarta. The sampling frame included students from five different vocational high schools representing diverse socioeconomic backgrounds and academic programs. The sample taken consisted of 80 students who were randomly selected from various majors in SMK, including information technology, business administration, culinary arts, and automotive engineering. This diversity in majors was intentional to ensure representation across different types of academic disciplines that might have varying levels of technology integration.

Sampling was carried out using a simple random sampling technique to ensure that each student had the same opportunity to be selected as a respondent. The process involved obtaining complete class rosters from participating schools, assigning numbers to each student, and using a random number generator to select participants. The sample size of 80 was determined based on power analysis for correlation studies with a medium effect size, alpha level of 0.05, and power of 0.80.

The demographic breakdown of the sample was as follows:

Gender: 45 male students (56.25%) and 35 female students (43.75%)

Age range: 15-18 years, with a mean age of 16.7 years

Grade level: 30 students from grade 10 (37.5%), 28 students from grade 11 (35%), and 22 students from grade 12 (27.5%)

Academic majors: Information Technology (25 students), Business Administration (20 students), Culinary Arts (15 students), Automotive Engineering (20 students)

Research Instruments

The instrument used in this study was a questionnaire consisting of three main parts:

1. **Demographic Information:** This section collected respondents' demographic data, such as age, gender, grade level, and academic major. This information was important for understanding the context of the responses and for potential subgroup analyses.
2. **Virtual Assistant Usage Scale (VAUS):** This section measured the frequency and nature of virtual assistant use. The scale consisted of 15 items using a 5-point Likert scale (1 = Never, 2 = Rarely, 3 = Sometimes, 4 = Often, 5 = Very Often). Items covered various aspects of virtual assistant use, including:
 - Frequency of use for academic purposes
 - Types of academic tasks for which virtual assistants were used
 - Reliance on virtual assistants for information gathering
 - Verification practices when using information from virtual assistants
 - Perceived benefits of virtual assistant use
3. **Critical Thinking Self-Assessment Scale (CTSAS):** This section measured students' self-perception of their critical thinking abilities using a 20-item scale with a 5-point Likert scale (1 = Strongly Disagree to 5 = Strongly Agree). The scale was adapted from existing critical thinking assessment tools and covered the following dimensions:
 - Analysis of information
 - Evaluation of evidence
 - Inference and reasoning
 - Self-regulation and reflection
 - Problem-solving approaches

This questionnaire was designed using a Likert scale to quantify respondents' perceptions of the use of virtual assistants and their critical thinking skills. The questionnaire was tested first on 30 students outside the study sample to ensure its validity and reliability. The content validity of the questionnaire was checked by a panel of three experts in the field of education and educational technology, while reliability was measured using Cronbach's Alpha.

The pilot testing yielded the following reliability coefficients:

- Virtual Assistant Usage Scale: Cronbach's Alpha = 0.86
- Critical Thinking Self-Assessment Scale: Cronbach's Alpha = 0.82

These values exceed the threshold of 0.7, indicating good internal consistency reliability for both scales.

Data Collection Procedures

Data collection was carried out by distributing questionnaires to selected respondents after obtaining necessary permissions from school administrators and informed consent from participants (and their parents for minors). The questionnaire was distributed directly at the school with the help of teachers to ensure a high level of participation and to address any questions or concerns that respondents might have.

Prior to administering the questionnaire, respondents were given a thorough explanation regarding the purpose of the study, the voluntary nature of their participation, the confidentiality of their responses, and how to fill out the questionnaire. Each participant was given approximately 30 minutes to complete the questionnaire in a classroom setting with a researcher present to address any questions. The data collection process was completed within a two-week period across all participating schools.

To maximize response rate and data quality, the following steps were taken:

1. Clear instructions were provided both verbally and in writing
2. Confidentiality was emphasized to encourage honest responses
3. The questionnaire was administered during regular school hours to ensure participation
4. Make-up sessions were arranged for absent students
5. Completed questionnaires were immediately checked for completeness

The response rate was 93.75%, with 75 of the 80 selected students completing the questionnaire fully. Incomplete questionnaires were not included in the final analysis.

Data Analysis Techniques

The data collected was analyzed using IBM SPSS Statistics Version 26. Data analysis was carried out in several stages:

1. Preliminary Data Analysis:

- Data cleaning and screening for missing values and outliers
 - Normality testing using Kolmogorov-Smirnov and Shapiro-Wilk tests
 - Descriptive statistics including means, standard deviations, frequencies, and percentages for demographic variables and main study variables
2. **Primary Analysis:**
- Descriptive analysis of the frequency of virtual assistant use and self-assessment of critical thinking skills
 - Pearson correlation analysis to examine the relationship between virtual assistant usage and critical thinking skills
 - Chi-Square analysis to determine the association between categorical variables derived from the main measures
 - Independent t-tests and one-way ANOVA to examine potential differences in the main variables based on demographic factors
3. **Additional Analysis:**
- Multiple regression analysis to control for potential confounding variables
 - Factor analysis to validate the construct validity of the instruments
 - Subgroup analyses based on demographic variables

The results of the statistical analyses were interpreted using the following criteria:

1. For Pearson correlation: $r < 0.3$ (weak correlation), $0.3 \leq r < 0.7$ (moderate correlation), $r \geq 0.7$ (strong correlation)
2. For statistical significance: $p < 0.05$ was considered statistically significant

3. For Chi-Square analysis: significance was determined based on the p-value with the conventional threshold of 0.05

The results of the analyses were presented in the form of tables, graphs, and narrative descriptions to facilitate comprehensive interpretation.

ETHICAL CONSIDERATIONS

This research was conducted by adhering to ethical research principles. Before data collection, formal approval was obtained from the University Ethics Committee (UEC) and permission from school administrators. Informed consent was obtained from all respondents and their parents or guardians for participants under 18 years of age.

Participants were informed that:

1. Their participation was entirely voluntary
2. They could withdraw from the study at any time without penalty
3. All data collected would be kept confidential and anonymous
4. The research results would be used only for academic purposes
5. Individual responses would not be shared with teachers or school administrators

All data was stored securely on password-protected devices, and physical copies of completed questionnaires were kept in locked cabinets. Participants were assigned identification numbers, and personally identifiable information was kept separate from the research data.

RESULTS AND DISCUSSION

Descriptive Statistics of Virtual Assistant Usage

The study found that the use of virtual assistants among SMK students in Jakarta is quite high. Table 1 presents the distribution of virtual assistant usage among respondents.

Table 1: Frequency of Virtual Assistant Usage (N=75)

Usage Category	Frequency	Percentage
Very Often	23	30.7%
Often	31	41.3%
Sometimes	14	18.7%
Rarely	5	6.7%
Never	2	2.6%

As shown in Table 1, the majority of students (72%) reported using virtual assistants "Often" or "Very Often" to help complete their school assignments. Only 2.6% of respondents reported never using virtual assistants. These findings indicate that virtual assistant technology has

become an integral part of the learning process for these students.

Further analysis of the types of tasks for which students use virtual assistants revealed interesting patterns, as shown in Table 2.

Table 2: Types of Tasks for Virtual Assistant Usage (N=75)

Task Type	Percentage of Students
Information search	92.0%
Answering specific questions	85.3%
Summarizing information	76.0%
Writing assistance	68.0%
Translation	65.3%
Mathematical problem solving	54.7%
Creative content generation	48.0%

Information search was the most common use case for virtual assistants, with 92% of students reporting using these tools for this purpose. Writing assistance and content summarization

were also common applications, used by 68% and 76% of students respectively.

When asked about their primary reasons for using virtual assistants, students provided responses summarized in Table 3.

Table 3: Primary Reasons for Using Virtual Assistants (N=75)

Reason	Percentage of Students
Time efficiency	88.0%
Ease of information access	84.0%
Help with difficult concepts	74.7%
Assignment completion	70.7%
Learning new topics	58.7%
Verification of information	41.3%

Time efficiency emerged as the most common motivation for using virtual assistants, followed closely by ease of information access. This suggests that students value virtual assistants primarily for their convenience and efficiency in the learning process.

Critical Thinking Confidence Assessment

Students' critical thinking abilities were measured through self-reported confidence levels across multiple dimensions of critical thinking. The overall distribution of critical thinking confidence is presented in Table 4.

Table 4: Overall Critical Thinking Confidence (N=75)

Confidence Level	Frequency	Percentage
Very Confident	18	24.0%
Somewhat Confident	34	45.3%
Less Confident	19	25.3%
Not Confident	4	5.3%

The results indicate that most students (69.3%) reported being "Somewhat Confident" or "Very Confident" in their critical thinking abilities. Only a small percentage (5.3%) reported not being confident in their critical thinking skills.

A more detailed examination of specific critical thinking dimensions revealed varying levels of confidence across different aspects of critical thinking, as shown in Table 5.

Table 5: Confidence Levels in Specific Critical Thinking Dimensions (N=75)

Critical Thinking Dimension	Mean Score (1-5)	Standard Deviation
Identifying main ideas	4.12	0.78
Recognizing relevant information	3.95	0.86
Evaluating source credibility	3.41	1.05
Analyzing arguments	3.56	0.92
Detecting logical fallacies	3.18	1.12
Drawing reasoned conclusions	3.72	0.89
Considering alternative viewpoints	3.85	0.94
Self-correcting thinking processes	3.49	1.03

Students reported highest confidence in identifying main ideas and recognizing relevant information,

while they were less confident in detecting logical fallacies and evaluating source credibility. This

pattern suggests that students feel more confident in basic information processing tasks compared to more complex evaluative aspects of critical thinking.

Statistical Analysis of the Relationship

Table 6: Pearson Correlation Between Virtual Assistant Usage and Critical Thinking Confidence

Variables	Correlation Coefficient (r)	p-value
Virtual Assistant Usage Score and Critical Thinking Confidence Score	0.123	0.293

The correlation coefficient of 0.123 indicates a weak positive correlation between virtual assistant usage and critical thinking confidence. However, the p-value of 0.293 exceeds the conventional threshold of 0.05, indicating that this correlation is not statistically significant. This suggests that there is no significant linear relationship between the

Pearson Correlation Analysis

A Pearson correlation analysis was conducted to examine the relationship between virtual assistant usage scores and critical thinking confidence scores. The results are presented in Table 6.

frequency of virtual assistant usage and students' confidence in their critical thinking abilities.

Chi-Square Test Results

To further examine the relationship between these variables, a chi-squared test was conducted using categorized data. The frequency distribution for this analysis is presented in Table 7.

Table 7: Cross-tabulation of Virtual Assistant Usage and Critical Thinking Confidence

Virtual Assistant Usage	Very Confident	Somewhat Confident	Less Confident	Not Confident	Total
Very Often	6	10	6	1	23
Often	7	15	8	1	31
Sometimes	3	7	3	1	14
Rarely	2	1	1	1	5
Never	0	1	1	0	2
Total	18	34	19	4	75

The chi-squared test based on this cross-tabulation yielded the following results:

Chi-Square Value (χ^2): 9.86

Degrees of Freedom (df): 16

p-value: 0.874

Testing criteria employed:

If p-value < 0.05, there is a significant relationship between the two variables

If p-value $\geq$ 0.05, there is no significant relationship

Since the p-value (0.874) is greater than 0.05, the analysis reveals that there is no significant relationship

CONCLUSION

Based on the comprehensive analysis of data collected from Vocational High School students in Jakarta, this study yields several important findings regarding the relationship between virtual assistant usage and critical thinking skills.

Firstly, the research confirms the widespread integration of virtual assistants into the academic lives of students. The data clearly indicates that a significant majority of students utilize these tools

frequently to aid in completing their school assignments. This high prevalence underscores the growing importance of virtual assistants as educational resources, driven primarily by students' need for time efficiency and easy access to information. Students value the convenience and speed that virtual assistants offer, which aligns with the increasing digitalization of educational environments.

Secondly, the study provides a detailed picture of students' self-perceived critical thinking abilities. While a substantial portion of students express confidence in their critical thinking skills, this confidence is not uniform across all areas. Students tend to rate themselves higher in foundational skills like identifying main ideas and recognizing relevant information, but demonstrate less confidence in more advanced cognitive processes such as evaluating source credibility and detecting logical fallacies. This disparity suggests that while students feel capable of basic information processing, they may struggle with the more nuanced and analytical aspects of critical thinking.

Thirdly, and most crucially, the statistical analyses conducted in this study reveal no significant relationship between the frequency of virtual assistant use and students' self-reported confidence in their critical thinking skills. Both Pearson correlation and Chi-Square tests indicate that the extent to which students use virtual assistants does not significantly correlate with their perception of their critical thinking abilities. This finding challenges the concern that increased reliance on virtual assistants might automatically lead to a decline in students' critical thinking capacity. Instead, it implies a more complex interplay between technology use and cognitive development.

In conclusion, the findings of this research offer valuable nuanced insights that contribute to the ongoing discourse on technology's role in education and its influence on cognitive skills. The study suggests that virtual assistants can indeed serve as complementary tools within the educational framework, offering support and convenience without necessarily impeding the development of students' critical thinking abilities. However, it is imperative to emphasize the importance of a balanced and guided approach to technology integration. Educators play a crucial role in designing learning strategies that not only leverage the benefits of virtual assistants but also actively promote and cultivate students' critical thinking skills. This involves equipping students with the skills to critically evaluate information, discern credible sources, and engage in deep analytical thinking, ensuring that technology enhances rather than replaces these essential cognitive processes.

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