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RESEARCH ARTICLE

KNOWLEDGE, AWARENESS AND ATTITUDE OF PRE PRACTITIONERS, INTERNS, POST GRADUATES AND DENTAL EDUCATORS TOWARDS THE DIGITALIZATION OF OPD IN DENTAL SCHOOLS - A MULTI CENTRIC QUESTIONNAIRE BASED STUDY

Dr. Rupa Chandini Dabbiru BDS, MDS[1*], Dr. Suresh Kumar Pakki[2], Dr. Venkata Ramani Chintada[3], Dr. Manish Kumar[4], Dr. Sunil Kumar Bonu[5], Dr. Shiva Shankar Gummaluri[6]

[1*]Associate Professor, Department of Oral Medicine and Radiology, GITAM Dental College and Hospital, Chinna Rushikonda, Visakhapatnam, Andhra Pradesh, India. Email ID- dr.chandini29@gmail.com, ORCID ID:0009-0005-4447-0228

[2]Professor & Head of Department, Department of Oral Medicine and Radiology, GITAM Dental College and Hospital, Chinna Rushikonda, Visakhapatnam, Andhra Pradesh, India.

[3]Assistant Professor, Department of Oral Medicine and Radiology, GITAM Dental College and Hospital, Chinna Rushikonda, Visakhapatnam, Andhra Pradesh, India.

[4]Professor & Head of Department, Department of Public Health Dentistry, GITAM Dental College and Hospital, Chinna Rushikonda, Visakhapatnam, Andhra Pradesh, India.

[5]Associate Professor, Department of Public Health Dentistry, GITAM Dental College and Hospital, Chinna Rushikonda, Visakhapatnam, Andhra Pradesh, India.

[6]Assistant Professor, Department of Periodontology and Implantology, GITAM Dental College and Hospital, Chinna Rushikonda, Visakhapatnam, Andhra Pradesh, India.

***Corresponding author** Dr. Rupa Chandini Dabbiru, Associate Professor, Department of Oral Medicine and Radiology, GITAM Dental College and Hospital, Chinna Rushikonda, Visakhapatnam, Andhra Pradesh, India. Email ID: dr.chandini29@gmail.com

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Abstract

Background: Digitalization in dental outpatient departments (OPDs) has the potential to significantly improve dental education and patient care. However, research on the awareness, proficiency, and attitudes towards digital tools among dental students and educators is limited. This study examines the impact of digitalization in dental OPDs, focusing on how factors such as gender, educational status, and college affiliation influence perceptions and familiarity with digital tools.

Materials and Methods: This cross-sectional study involved dental students and educators from various dental colleges of the newly formed state of Andhra Pradesh. Data was collected through structured questionnaires assessing awareness, proficiency, and attitudes toward digitalization in OPDs. Statistical analysis, including Chi-Square tests, were conducted to explore associations between educational status, gender, and perceptions of digital tools. The sample included final BDS students, interns, postgraduates, and dental educators.

Results: The findings indicated that 91.3% of participants were aware of digitalization, and 52.0% had received training in digital tools. Educational status was significantly associated with proficiency, with postgraduates and educators showing higher expertise in using digital tools. Gender differences were evident, with females more likely to view digitalization positively, especially in terms of enhancing patient care and follow-up. Moreover, significant differences were observed across the colleges regarding the extent of digital tool training, indicating variability in institutional approaches to digital education.

Conclusion: The study underscores the importance of integrating digital tools in dental education and practice. It reveals the need for targeted digital training programs that consider educational status, gender, and institutional factors. The results suggest that dental schools should standardize digital education to ensure all students and educators are adequately prepared for the evolving digital landscape in dentistry.

Keywords: Digitalization, Dental Education, Outpatient Departments, Gender Differences, Training, Awareness, Perceptions

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INTRODUCTION

Digitalization offers a wide array of technologies that helps to optimize dental care. These tools can facilitate better communication between dental practitioners and patients, enhance treatment planning and collaboration among healthcare providers, and improve the patient experience. However, the successful adoption and implementation of these technologies depend significantly on the awareness, familiarity, and proficiency of dental students and educators.

As digital tools become an integral part of dental institutions, understanding the perceptions and attitudes of dental students towards these changes becomes crucial for effective curriculum design and training initiatives.

Digitalization encompasses a wide range of technologies, including electronic health records (EHRs), tele dentistry, digital imaging, and appointment scheduling systems, all of which aim to improve the efficiency and quality of dental care. As the dental profession increasingly utilises digital tools such as electronic health records (EHRs), digital imaging, tele dentistry, and automated appointment scheduling, it is essential to assess how these innovations are perceived by those who will be utilizing them in their future careers. Therefore, evaluating their awareness, attitudes, and benefits of digitalization is essential for informing educational strategies and training programs.

This study aims to explore the perceptions of dental students across various dental institutions, regarding the impact of digitalization on critical aspects of dental education and practice. The research focuses on several key areas, including communication, efficiency, collaborative practices, accessibility of dental care, administrative effectiveness, and the scope for ongoing improvements in digitalization practices.

By examining these perceptions, this study aims to identify potential barriers to the effective integration of digital technologies, highlight areas where educational strategies may need to be adjusted, and discover opportunities to enhance student readiness for a technology-driven healthcare environment.

As new generations of dental practitioners enter the field, they must be equipped not only with clinical skills but also with the technological competencies which will help them to survive in a digital world. Consequently, this study will explore critical questions such as:

What are the current levels of awareness and familiarity with digital tools among dental students? How do perceptions of digitalization vary across different demographic groups, including gender and educational status?

What benefits and challenges are associated with the integration of digital technologies in dental OPDs?

By addressing these questions, the study aims to contribute valuable insights into the integration of digitalization of OPD in dental education, ultimately having a more effective and innovative approach to dental care.

This study aims to assess the awareness and perceptions of dental stakeholders (Final BDS students, interns, postgraduates, and dental educators) regarding the digitalization of outpatient departments (OPDs) in dental education using a structured questionnaire.

Objectives

- To evaluate awareness of digitalization in OPDs among dental students and educators.
- To investigate attitudes towards the benefits and challenges of digitalization in treatment efficacy, communication, collaboration, and patient experience.
- To assess familiarity and proficiency with digital tools, including training experiences.
- To explore gender and educational status differences in perceptions of digitalization in OPDs.

METHODS

- This cross-sectional survey assessed dental students' perceptions of the digitalization of outpatient departments

(OPDs) in various dental colleges of the newly formed state of Andhra Pradesh. The study targeted 400 participants, including final BDS students, interns, postgraduates, and dental educators, to provide reliable insights into the digitalization perceptions in dental education. The Institutional Ethical Committee approval was obtained for the study.

- Data was collected using a structured online questionnaire, which comprised 20 questions, including demographic information (age, gender, educational status, awareness of digitalization in OPDs, training experiences, and attitudes toward its benefits and challenges. The questionnaire was distributed via email and WhatsApp in Google Form format for ease of access and completion.
- The questionnaire was divided into three sections: demographic details (Q1-3), knowledge-based questions (Q4-10), and awareness (Q11-20). A pilot study involving 20 dental students was conducted to test the validity and reliability of the questionnaire. Feedback from the pilot study led to adjustments in question clarity and format. The final version was validated by subject matter experts to ensure it accurately measured the intended concepts.
- Reliability analysis revealed a Cronbach's alpha score of 0.8, confirming internal consistency. Participants had two weeks to complete the online survey. Data was then tabulated and analyzed using SPSS software. Descriptive statistics were employed to summarize demographic characteristics and responses. Chi-square tests examined associations between categorical variables, particularly gender and educational status, with a significance level set at $p < 0.05$.

RESULTS

The study had a predominance of female participants, with 68.0% (282 respondents) being female and 32.0% (133 respondents) being male (figure 1).

The study participants were evenly distributed across different categories, with 25.3% (105 respondents) being postgraduates, 25.1% (104 respondents) final-year BDS students, 24.8% (103 respondents) interns, and 24.8%(103 respondents) dental educators(fig. 2).

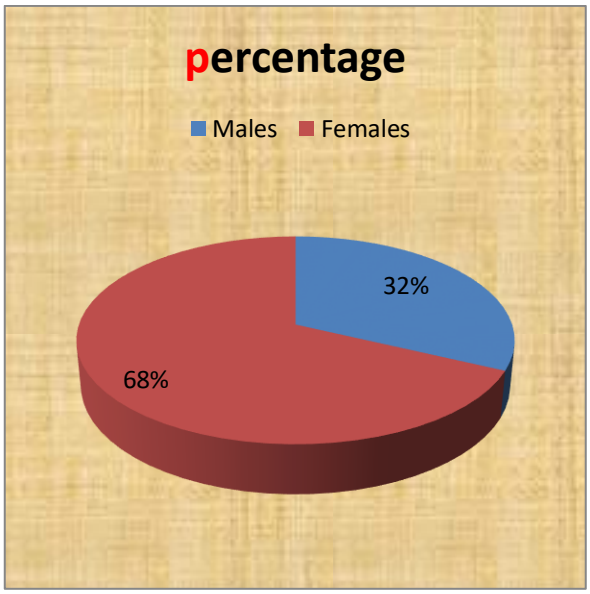

Figure 1 - Gender Distribution

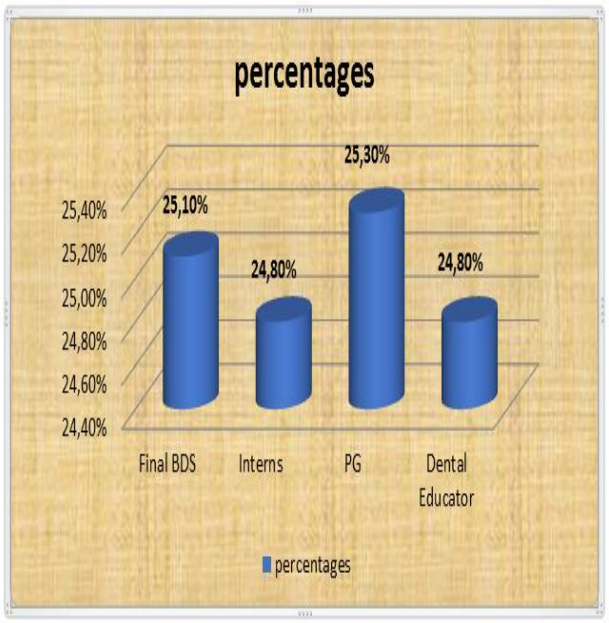

Figure 2 - Educational status

Table 1 – shows the participants knowledge and awareness regarding digitalization of OPD

Question	Strongly Disagree	Disagree	Natural	Agree	Strongly Disagree
Digitalization has the potential to improve efficacy and accuracy in the dental OPD	0 (0%)	0 (0%)	49(11.8%)	208 (50.1%)	158 (38.1%)
Digitalization of OPDs in dental schools will decrease time required for treatment planning	1(2%)	28(6.7%)	79(19%)	200 (48.2%)	107 (25.8%)
Digitalization of OPDs in dental school will enhance patient communication and education through the use of digital platforms	0(0%)	11(2.7%)	63(15.2%)	229 (55.2%)	112 (27%)
Use of of Digital systems in OPDs will facilitate better collaboration among dental students and faculty	0(0%)	3(0.7%)	78(18.8%)	217 (52.3%)	117 (28.2%)
Digitalization of OPDs leads to reduction in administrative errors in patient records	4(1%)	13 (3.1%)	75 (18.1%)	199 (48%)	124 (29.9%)
Digitalization of OPDs in dental schools provide more personalized treatment options for patients	0(0%)	13(3.1%)	67 (16.1%)	236 (56.9%)	99(23.9%)
Digitalization of OPDs will encourage more efficient appointment scheduling for patients	0(0%)	2 (0.5%)	46 (11.1%)	236 (56.9%)	131 (31.6%)
Question	Significantly improves	Somewhat improves	No effect	Somewhat worsens	Significantly worsens
Digitalization of OPDs will impact the accessibility of dental care for patients	180 (43.4%)	181 (43.6%)	53(12.8%)	1(0.2%)	0(0%)
Digitalization of OPDs in dental school affects the overall patient experience	165 (39.8%)	201 (48.4%)	48 (11.6%)	1 (0.2%)	0 (0%)
Question	Very important	Important	Neutral	Not Important	Not sure
How important is it for dental student to be well versed in using digitalization of OPD for their future prospects/career?	173 (41.7%)	199 (48%)	38 (9.2%)	1(0.2%)	4(1%)

Table 2 shows perceptions and insights on digitalization of OPD

Question	Yes	No
Awareness of digitalization of OPD used in dental colleges	379 (91.3%)	36 (8.7%)
Received any training or orientation on using digital tools in Dental OPD	216 (52%)	199 (48%)
Increase in digitalization of OPD might reduce direct patient interaction	218 (52.6%)	197 (47.4%)
Digitalization of OPD helps in patient follow up protocol which in turn benefits the patient	401 (96.6%)	14 (3.4%)
Digitalization Of OPD has to be kept uniform in all dental schools across India	336 (80.9%)	79 (19.1%)
Do you think digitalization of OPD can be further improved	378 (91%)	37 (9%)

The study on digitalization in dental OPDs highlights strong support for its benefits. A majority of participants (68%) were female, with representation across educational levels, including final BDS students, interns, postgraduates, and dental educators.

Awareness of digitalization was high (91.3%), and while 52% had training, many reported feeling familiar (56.1%) or proficient (33.3%) in using digital tools.

Participants expressed confidence in the positive impacts of digitalization, with 88.2% believing it enhances treatment efficacy and 96.6% acknowledging its role in patient follow-up.

Concerns about reduced patient interaction were raised by 41.7%, emphasizing the need for balance.

Despite this, 89.7% agreed that proficiency in digital skills is crucial for future careers. Many felt that digital tools foster collaboration (80.5%) and reduce administrative errors (77.9%).

Digitalization was also seen as beneficial for personalized treatment (80.8%) and improving accessibility to dental care (87.0%).

Additionally, 88.5% believed digital tools would improve appointment scheduling, and 88.2% felt it would enhance the patient experience. The majority (82.7%) recognized opportunities for further improvement in digital practices.

Overall,

these findings demonstrate a strong endorsement of digital tools in dental education and practice, along with a willingness to embrace ongoing advancements.

Also, the study revealed several significant insights regarding gender, educational status, and college affiliation in the context of digitalization of outpatient departments (OPDs) in dental education.

Table 3 shows statistical significanc observed among different parameters

Question	Gender Chi-square value (p-value)	Educational status Chi-square value (p-value)	College Chi-square value (p-value)
Digitalization has the potential to improve efficacy and accuracy in dental OPD	1.931(0.38)	3.3(0.770)	7.338 (0.291)
Digitalization of OPDs in dental school will decrease time required for treatment planning	15.829(0.003)*	20.608(0.056)*	15.171 (0.232)
Digitalization of OPDs in dental school will enhance patient communication and education through the use of digital platforms	6.043(0.110)	33.743(0.00)*	31.556(0.000)*
Digital systems in OPDs will facilitate better collaboration among dental students and faculty	10.842(0.013)*	32.962(0.00)*	26.189(0.002)*
Digitalization of OPDs leads to reduction in administrative errors	4.589(0.33)	20.203(0.063)	50.055(0.000)*
Digitalization of OPDs in dental schools will provide more personalized treatment	7.8(0.05)*	24.498(0.004)*	25.657(0.002)*
Digitalization of OPDs will encourage more efficient appointment scheduling for patients	9.106(0.02)*	13.658(0.135)	19.515(0.021)*
Digitalization of OPDs will impact the accessibility of dental care for patients	9.478(0.02)*	11.673(0.232)	25.432(0.003)*
Digitalization of OPDs in dental school affects the overall patient experience	11.038(0.012)*	18.368(0.031)*	30.750(0.000)*
How important is it for dental student to be well versed in using digitalization of OPD for their future prospects/career?	5.793(0.2)	22.507(0.032)*	28.671(0.004)*
Level of familiarity with digitalization used in dental OPD	4.062(0.131)	46.68 (0.00)*	5.552(0.475)*
Awareness of Digitalization of OPD used in dental colleges	0.04(0.84)	15.27 (0.002)*	11.498(0.009)*
Received any training or orientation on using digital tools in Dental OPD	2.036(0.154)	9.12 (0.028)*	29.829(0.000)*
Increase in digitalization of OPD might reduce direct patient interaction	5.970 (0.051)*	9.036(0.172)	11.180(0.083)

Digitalization of OPD helps in patient follow up protocol which in turn benefits the patient	0.77(0.378)	12.240(0.007)*	0.865(0.834)
Digitalization Of OPD has to be kept uniform in all dental schools across India	4.110(0.128)	8.769(0.187)	6.86(0.33)
Digitalization of OPD can be further improved	0.50(0.776)	6.275(0.393)	10.345(0.111)

*Pearsons chi-square test, p <0.05 (S)**

Gender: Chi-Square test results indicate significant gender-based differences in perceptions of digitalization's impact on treatment planning, collaboration, and patient communication. Males tend to show a slightly stronger agreement with the benefits of digital tools in reducing treatment planning time, fostering collaboration, and providing personalized treatment options. However, both genders generally agree that digitalization enhances the accessibility of dental care and improves patient experiences. Notably, males are more inclined towards seeing the effectiveness of digital tools in providing personalized treatment, while females express stronger consensus on their benefits for patient communication and follow-up.

Educational Status: There is a significant relationship between educational status and awareness, familiarity, and perceptions of digitalization. The p-value of 0.002 indicates that different educational levels—final BDS students, interns, postgraduates, and dental educators—show varying awareness levels of digital tools in OPDs. Higher educational status correlates with greater familiarity and proficiency in using these digital tools, with postgraduates and educators being more confident in utilizing digital systems. Perceptions of digitalization's impact on patient care, collaboration, and treatment personalization also differ by educational status, with higher educational levels recognizing its benefits more strongly. The study suggests that digital skills training should be tailored according to the educational level to ensure effective adoption across all stages.

College Affiliation: College affiliation also plays a critical role in shaping perceptions of digitalization. Significant differences were found in awareness and training experiences regarding digital tools across different colleges. The p-value of 0.002 suggests that some colleges are more proactive in training students on digital tools in OPDs. College affiliation further influences students' attitudes towards digital skills in dental practice, with some institutions emphasizing the importance of digital tools more than others. Additionally, students from colleges with strong digitalization programs tend to view digitalization more favourably, especially in terms of improving patient care, accessibility, and appointment scheduling efficiency.

Gender, educational status, and college affiliation significantly influence dental students' and educators' perceptions of the digitalization of OPDs. These findings highlight the need for targeted interventions and strategies that consider these demographic factors to enhance the integration of digital tools in dental education and practice.

Discussion

This study highlights the transformative role of digitalization in dental education and practice, reflecting broader trends in healthcare technology. A high level of awareness (91.3%) and familiarity with digital tools among participants aligns with global adoption patterns, as noted by Hall et al[1] (2023). The reported training levels (52%) underscore efforts to integrate technology into curricula, supported by recommendations from organizations like the American Dental Education Association.

The perceived benefits of digitalization—such as enhanced treatment efficacy (88.2%) and improved patient follow-up (96.6%)—echo findings from Avhad et al[2](2022), who emphasized how digital tools optimize clinical workflows and outcomes. Additionally, the recognition of improved accessibility (87.0%) and personalized treatment options (80.8%) is consistent with Nayakar et al [3] (2022) conclusion that digital systems reduce healthcare disparities and facilitate tailored interventions.

Concerns about reduced patient interaction (41.7%) reflect a critical issue in the digitalization discourse. Similar concerns were raised by Hall et al[1] (2023), who stressed the importance of maintaining patient- centered care amid technological reliance. Balancing digital tools with personal engagement is crucial, as noted in this study's findings.

The belief that proficiency in digital skills is essential for future careers (89.7%) aligns with Favaretto et al[6](2020), who identified digital competence as key in modern healthcare. Consensus on the benefits of digital systems for collaboration (80.5%) and reducing administrative errors (77.9%) mirrors Sharab et al[4](2022) observations in other healthcare disciplines.

Participants' advocacy for further improvements (82.7%) supports the need for continuous innovation, as suggested by Gross et al[7] (2019), who called for addressing challenges such as system usability and training gaps. Dental education can benefit from expanding digital training access while fostering a culture that embraces change. Chi-Square test results revealed significant associations between gender and various perceptions of digitalization in outpatient departments (OPDs). These findings suggest that demographic factors influence attitudes toward digital tools in dental education and practice. The relationship between gender and the belief in digitalization's benefits for treatment planning time ($p = 0.003$) implies that gender may shape perceptions of technological efficiencies, consistent with Tulasi et al[5] (2022).

The association between gender and perceptions of digitalization's role in collaboration ($p = 0.013$) highlights the importance of considering diverse perspectives in creating collaborative environments. Males showed slightly stronger agreement, while overall agreement across genders emphasizes digitalization's potential for fostering teamwork. These findings Sharab et al[4] (2022), who observed demographic differences in embracing collaborative tools.

Pearson Chi-Square results ($p = 0.050$) highlighted gender differences in attitudes toward personalized treatment options enabled by digitalization. Males were more favourable toward significant improvements, while females exhibited stronger consensus on the benefits, reinforcing Hall et al [1] (2023), who emphasized the need for tailored digital initiatives.

The study also found a significant relationship between gender and perceptions of digitalization's impact on accessibility and appointment scheduling efficiency. While females expressed higher agreement, males were more inclined to report significant improvements. This suggests differing expectations or experiences with digital systems, reflecting Favaretto et al[6] (2020) on gender-specific preferences in system design.

These gender-based differences emphasize the need for dental schools to consider diverse perspectives when implementing digital strategies. Addressing gender-specific concerns and leveraging shared views will create a more inclusive environment for digital adoption. Future research should explore barriers and preferences to refine these strategies, as recommended by Gross et al[7] (2019).

The Chi-Square results revealed significant associations between educational status and various aspects of awareness, proficiency, and perceptions of digitalization in OPDs. This underscores the influence of educational background on attitudes toward digital tools. The significant relationship between educational status and awareness ($p = 0.002$) suggests that training and exposure influence understanding of digital systems, as supported by Avhad et al[2] (2022).

The strong association between educational status and familiarity with digitalization ($p < 0.001$) emphasizes the importance of integrating digital competencies into curricula.

Postgraduates and dental educators showed higher familiarity, consistent with Tulasi et al[5] (2022), who identified postgraduate training as crucial for developing technical skills. This calls for targeted training programs to address gaps at the undergraduate and internship levels.

Differences in perceptions of digitalization's impact on career advancement further highlight the influence of educational status. Dental educators and postgraduates were more likely to emphasize the importance of digital skills, in line with Vander et al[6] (2018), who found that career stage influences attitudes toward technology adoption. Tailoring interventions to support lifelong learning in digital skills is essential.

The association between educational status and perceptions of digitalization's benefits for patient follow-up and communication ($p < 0.05$) reflects varying levels of exposure to digital tools in practice. Postgraduates and educators, more involved in patient care, recognized these benefits more strongly, as noted by Nayakar et al[3] (2022). Integrating real-world applications into undergraduate training could address this gap.

Finally, the study found strong associations between educational status and perceptions of personalized treatment options and overall patient experience ($p = 0.004$). Educators and postgraduates were more likely to value these benefits, reflecting a deeper understanding of patient-centered care. Hall et al[1] (2023) emphasized aligning digital systems with clinical goals to maximize impact.

This study underscores the need to tailor digitalization strategies to address the diverse perspectives of individuals at different educational levels. Targeted training programs can ensure that all stakeholders are equipped to effectively adopt digital technologies. Future research should focus on identifying barriers to adoption at each educational stage and developing interventions to overcome them.

Conclusion

The study emphasizes the pivotal role of digitalization in dental OPDs, highlighting the impact of demographic, educational, and institutional factors. Awareness and proficiency with digital tools varied by educational level, with postgraduates and educators showing higher competency. Gender differences were noted in perceptions of digital tools' benefits. The study stresses the need for targeted training, standardized curricula, and balanced approaches to ensure digital integration enhances patient care and operational efficiency.

DECLARATIONS

Conflicts of interest and financial disclosures

No conflict **of interest** and there was no external source of funding for the research in question.

Ethical approval

Study was approved by Institutional Research Review Board, GITAM Dental College and Review Board, GITAM Dental College and Hospital, Visakhapatnam, Andhra Pradesh, India.

Informed consent

Informed consent was obtained from all individual participants included in the study.

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The work was not funded.

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