

# Perception of Techno-stress among University Undergraduates

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## Abstract

The field of Human-Computer Interaction (HCI) is multidisciplinary, cutting across computer science, psychology, cognitive science, and organizational and social sciences. In the social sciences, HCI tries to understand students' experiences, and resultant effects based on interaction with technology. As technology integration in education keeps rising, the need arises to examine the side effects of constant, and prolonged use of technology by students because there has been concern about how human-computer interaction, especially on devices with screens or other forms of user interfaces, influences techno-stress (technology-influenced stress) among students. This study, therefore, examined human-computer interaction and techno-stress among undergraduates. The descriptive survey of the non-experimental design was adopted, and the sample comprised 313 final-year undergraduates, to whom an instrument titled "Technology-Generated Stress Questionnaire (CGSQ)" ( $r = .74$ ), was administered for data collection. Descriptive and inferential statistics of Median, S.D, T-test, and One-Way ANOVA, were used for analysis at 0.05 alpha level. Findings showed that undergraduates have positive perceptions of technology-influenced stress, and based on gender and age, no significant difference exists in their perceptions. Stakeholders need to come up with policies guiding students' interaction with technology for learning purposes to avert negative consequences on their mental well-being.

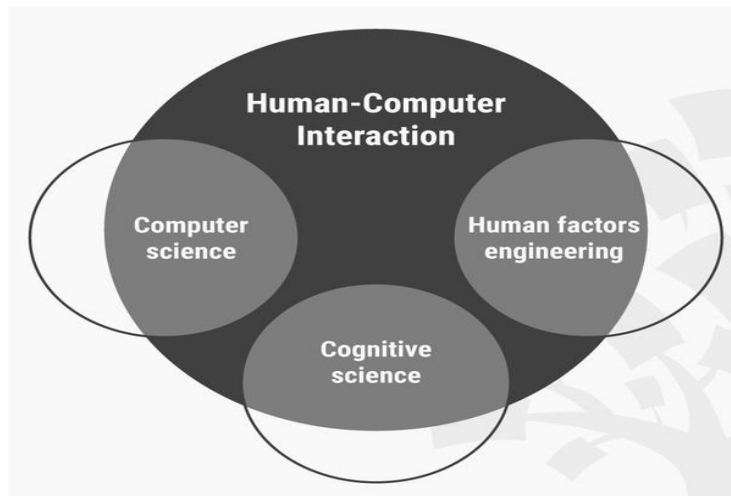
**Keywords:** human-computer interaction, techno-stress, university undergraduates, Ogun state, Nigeria

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## INTRODUCTION

As the world advances, especially towards the Fourth Industrial Revolution (4IR), the roles of smart technologies and information and communication technology continue to deepen in every sphere of human living. It seems that humans can no longer do without technologies in their daily lives. Technologies are gradually taking over the place that both electrical and electronic gadgets such as radios, and televisions, among others, were earlier dear to humans. Nowadays, the use of computers has almost become irreplaceable; taking over the time that humans normally spend during physical interactions with other humans, while interaction time with computers and other forms of modern technologies is fast increasing. The importance of, and reliance on technologies earlier led to the emergence of the field referred to as Human-Computer Interaction (HCI) (Carneiro, et al. 2016).

The field of HCI studies the interaction between humans and computers. The Association for Computing Machinery (2009), states that HCI as a discipline, involves the designing, evaluating and implementing of computing systems designed to be interactive for humans use. It is also concerned with the study of the major phenomena surrounding the interaction. It is also a study of how human users utilize computers to carry out their daily operations in such a way that the interactions are effective and enjoyed. HCI is made up of three parts - user, computer, and interaction (Baral & Sharma, 2019). The field of HCI is often referred to as being the intersection between computer science, behavioural science, design, and other fields of study.

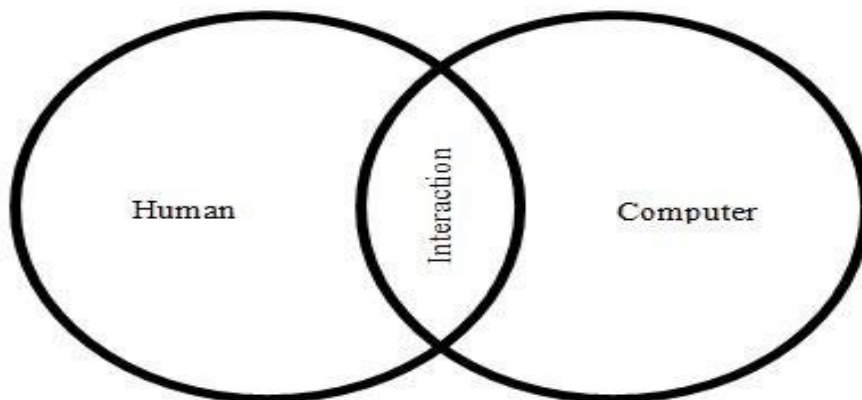


**Figure 1:** The multidisciplinary field of HCI

(Image source: <https://www.quora.com/What-are-the-basics-of-human-computer-interaction>)

Due to advancements in digital technologies and literacies, different disciplines, including User Experience Design (UXD) and Human-Computer Interaction (HCI), have become increasingly important because people's interaction with technology is becoming increasingly important (Crearie, 2016). HCI is a multidisciplinary field drawing on fields such as computer science, cognitive science, psychology, and organisational and social sciences to understand how humans experience and utilize interactive technologies (Lopes, 2016). The aim of the field of HCI, among others, is to improve the interaction between users and their devices by ensuring that the mechanisms of computer interaction adapt to human users and the tasks, instead of the other way around (Carneiro et al. 2016). Many technologies require that users interact with them. Hence, Graphic User Interface (GUI), which usually has graphics as one of its components, aids users of computers to interact with systems either by clicking or selecting a menu or a button, ticking boxes, or scrolling to perform certain tasks. GUI gives users access to the features of a program on a system. An intuitive user interface, therefore, is important to good computing (Singh, 2017). HCI has also been viewed as the combination of two powerful information processors, human and computer, both attempting to interact via a narrow-bandwidth, and highly constrained interface (Tufte, 1989, cited in Thuseethan & Kuhanesan, 2015). HCI entails the relationship between humans and computers, and their mutual understanding. The initial step to HCI is having the ability to appropriately respond to, and sense users' affective responses; detect and interpret their affective states as shown by users.

As stated earlier, HCI, as the name connotes, is made up of three major parts within its framework. These are the user, the computer, and the interaction. This is conceptualized in Figure 2 below.



**Figure 2:** Human-computer interaction (Thuseethan & Kuhanesan, 2015)

The user, predominantly human, who is considered the user of the systems, is central to user-centred systems design. The basic features of the users are dependent on their purpose, experience, and tasks performed on the system. According to Danino (2001), the users are those using technology to perform

their desired tasks. The computer in Figure 1 connotes any technology ranging from desktop computers, smart and intelligent computers to super-advanced technologies since HCI focuses on interfaces between man and machine, it, therefore, connotes that every device, gadget or technology in general consists of one or some forms of a user interface to use it. The last part of the HCI components is interaction. This interaction happens between man and machine (Thuseethan & Kuhanesan, 2015). The interaction part is the surface or interface that connects the users and the machine. It is that part that users can touch, feel, speak to or interact with in any other form to issue instructions to the system for the desired outcome.

The field of HCI, being multidisciplinary, as it cuts across not just computer science and other IT fields, but also cognitive and social sciences to understand how humans experience and utilize interactive technologies (Lopes, 2016), is now of relevance in education. This is because the use of technologies in schools, particularly computers, has diversified the types of educational communications students engage in. Students now not just engage in interpersonal interactions with their lecturers, they also interact more in computer environments. They communicate with people, both in and outside the academic environment via technologies such as Social Media applications, smartphones and other handheld devices, among others, while also communicating directly with their devices or computers (Baral & Sharma, 2019; Pantic & Rothkrantz, 2003). In most cases, they tend to spend more time on their digital assistants (PDAs), laptops, cell phones/smartphones/tablets, notebooks, personal computers (PCs), and e-book readers (Sung, Chang, & Liu, 2016), among others, than they do with humans. This form of communication has involved the field of HCI in educational domains.

#### **TECHNOLOGY IN EDUCATION, TECHNO-STRESS, AND MENTAL WELLBEING**

There is no doubt that interactive technologies have extensively penetrated the field of education. This is because technologies now play significant roles in education via the utilization of e-learning environments and other different forms of computer-based academic support devices in almost all the spheres of instructional processes. The application of technologies in the field of education is leading the field towards an era of electronic academic supportive devices, and the extensive use of digital devices such as tablet pcs, notebooks, and smartphones, among others (Thuseethan & Kuhanesan, 2015). The gains also include the fact that technologies can create active learning for learners, improve students' thinking power, improve language competencies, and improve their skills, among other gains (Hadi et al. 2022). Also, technologies in education offer attractive, interactive, interesting, personalised, and more realistic teaching and learning facilities to academia. In addition, technologies in and outside of classrooms assist in enhancing the teaching and learning environments for not just students, but also their teachers and the school community as a whole. They also help to increase students' motivation toward learning, and their overall learning outcomes (Vibert & Mackinnon, 2002).

The extensive use of computers in education needs to be examined in terms of their effects on students' well-being. The emergence of the Covid-19 pandemic has increased students' interaction time with technologies. This is because, more than ever, students have to use technologies to ensure that learning continues. This has also made the landscape of education, which was formerly more face-to-face, become more of a student-technology format, thereby bringing significant changes globally to how instructional content is presented to students. While the use of technologies in the field of education is not new, their increasing use to present content to students via online instructional platforms vis-à-vis online learning, online education, or e-learning, especially concerning the advent of the Covid-19 pandemic, has endeared students to their gadgets more than ever. With the current embrace of online education globally, and with the position that another pandemic might break out at any moment, it is therefore not certain that teaching and learning will return to the normal physical classes. And even if it doesn't, the use of technologies might not be ruled out completely (Adelana & Akinyemi, 2021). With the increasing use and reliance on technologies for teaching and learning, the issue of students' mental health and wellbeing is increasingly growing, especially concerning HCI (Sanche et al. 2019).

In education, mental well-being is a topic of concern, especially as a result of the impact of the Covid-19 on the education landscape globally. The issue of mental wellbeing continues to emerge especially as students and institutions are now massively transitioning from face-to-face classrooms to online learning platforms, which, in most cases, do not give room to undergraduates to directly communicate their feelings in a physical-relation format to their peers and lecturers. The constant and prolonged use of technology for learning among undergraduates therefore and its attendant consequences require that urgent steps be taken because researchers have reported mental state, behaviour, and health is influenced by stress (Sydney-Agbor, et al. 2018). In addition, issues relating to mental well-being among undergraduates have received lots of attention in education, especially concerning online learning, and this is a result of the stress levels among undergraduates' independent living, learning, heavy academic workloads, and pressure (Kunjiapu & Kunasegaran, 2021). As noted by Woolston (2020), the importance attached to undergraduates' mental well-being has made positive psychology to be preferred in most studies related to mental well-being because it explores healthy traits of students' minds as against traditional psychology.

As a result of the rapid development and integration of diverse technologies in the educational landscape in Nigeria, in addition to undergraduates having to use them increasingly, the need, therefore, arises to examine how interaction with these technologies, especially those interactive screens, influence their level of stress and ultimately, their mental wellbeing. This study, therefore, examined how the interaction (use of technology) between students and technologies influences stress (technology-generated stress) among university undergraduates in Nigeria. Also, study examined the general perceptions of undergraduates on technology-influenced stress; determine if there is any significant difference in the perceptions of male and female undergraduates on technology-influenced stress; and, determine if there is any significant difference in the perceptions of undergraduates on technology-influenced stress based on age. The level of stress among undergraduates is increasing as they continually interacted with technologies, especially at a time when technologies is fast dominating

the real of education. While the increased level of stress among undergraduates students has long been examined, and stressors such as competition with other students, too much assignments, failures, lack of finance (Fairbrother & Warn, 2003), family challenges, poor relationships with others in school and outside, and university level stressors such as overcrowded lecture halls (Awino & Agolla, 2008; Ongori, 2007, cited in Bataineh, 2013), inadequate resources to carry out academic tasks, among others, have been identified, there is a lack of studies on human-computer interaction mediated stress among undergraduates in the Nigerian context.

## **LITERATURE REVIEW**

According to Goff (2011), university undergraduates experience some challenges in online learning which imply a strong indication of mental health issues among them, and the most experienced mental health challenge among university undergraduates is stress. Technology mediated techno-stress among undergraduates is their inability to adapt or give appropriate responses to the physical, emotional or mental demands of learning activities. This inability, according to Kwaah and Essilfie (2017), could be actual or imagined. Koolhaas *et al.*, (2011) posited that the body's reaction to changes demanding adjustment is referred to as stress. The body's reactions to this demand are physical, mental, and emotional. Stress, being a common experience in daily living likely comes from an individual's environment, thoughts, and actions or other means, but the implication is that it influences the person's thoughts, feelings, and behaviour, and is likely to result in serious implications on the person's health, especially mental health. According to the WHO (2020), issues relating to students' mental health are the leading challenges inhibiting students' success as they are likely to negatively affect their motivation, social interactions, and concentration, with several implications for their success in the university (World Health Organization, 2020).

The issue of stress in academic domains is now a subject of discussion. Researchers in the behavioural sciences have carried out extensive studies on stress and its consequences on students and came up with findings that the subject of stress needed more attention (Bataineh, 2013; Agolla, 2009; Ongori, & Agolla, 2008) because stress has been found to have both positive and negative consequences on students (Stevenson, & Harper, 2006). Having to study, and perform educational tasks under pressure among undergraduates has been found to correlate with anxiety, lower well-being (Cant, 2018; Centre for Education Statistics and Evaluation, 2015), and that working in a particular position [on computers] for prolonged periods induced stress and reduce concentration (Wennberg, 2016, cited in Dekker *et al.* 2020).

Researchers of technology-related stress present strong evidence claiming that stressors emerging from technology usage (techno-stressors) influence stress reactions, and reduce an individual's well-being (Srivastava *et al.*, 2015; Ayyagari *et al.*, 2011). Riedl (2013), based on his review about the body's feedback on a user's interaction with technology, reported that negative individual experiences resulted in high blood pressure, increased heart rate, and high-stress hormones levels. In essence, a user's reliance on technologies triggered a high level of techno-stress. In other words, technology-related

stress can significantly decrease an individual's levels of cognitive functioning, consequently reducing the technology-based task performance levels (Jurek et al. 2021).

Concerning gender, different studies reported differences in the amount of perceived technology-induced stress among students. Some studies such as those of Maier et al (2014), Tarafdar et al (2011), Ragu-Nathan et al. (2008), and Tarafdar et al (2007), have reported that technology-induced stress is experienced less in females compared to males (Fitzgerald, 2021). Also, according to Currie et al. (2012), females were more likely to report technology-related stress compared to males. The gender difference, according to Currie et al., was significant. Reporting on gender as influencing human-computer interaction, Hess et al. (2006), cited in Kuurstra (2015), reported that females reported being more involved compared with males. With regards to age, Thomée et al. (2010), reported that there is a high association between high use of technology, in the realms of hours spent working on the computer, and smartphones per week, Internet surfing, and mental health issues among undergraduates aged 19 to 25 years (Thomée, et al. 2007).

Specifically, stress as a reaction to prolonged computer use has been fingered in this situation, and this study specifically examined the issue of techno-stress among undergraduates as a result of prolonged interaction with computers and other input devices. Stress, within the stress theory, has been said to be induced by stressors, just as techno-stress (technology-induced stress) is induced by techno-stressors. Bataineh (2013), citing Campbell (2006), states that stress is the adverse reaction people experience as a result of prolonged pressure, or other demands that are placed on them. Issues relating to the possible side effects of prolonged exposure to computers or other technology-related screens are now been raised by concerned groups. Issues including ergonomics (Gerr et al. 2006), mental health (Nakazawa et al. 2002), techno-stress (stress reactions with regards to technology use) (Berg et al. 1992), have been studied. Also, Thomée, Härenstam and Hagberg (2012), citing Arnetz and Wiholm (1997) and Berg et al. (1992), have reported that prolonged use of computers can lead to psychophysiological stress reactions as a result of strain.

## **MATERIALS AND METHODS**

The study examined the relationship between human-computer interaction and the incidence of technology-induced stress amongst undergraduates in a Nigerian University. This study became imperative because students now interact more with their devices, especially since the Covid-19 forced almost all universities globally to turn to online learning since the face-to-face format of learning is fast becoming unsuitable as a standalone form of learning. Several concerns have been raised as students now stay longer on their technological devices to learn. In addition to this, the field of HCI, which is a multidisciplinary discipline which is not limited to the field of computer science alone, but also cuts across other fields such as cognitive and social sciences to understand how humans experience and utilize interactive technologies (Lopes, 2016). As more and more undergraduates get glued to their devices' screens, the need arises to examine the effect of such prolonged use of technology on their mental health, especially in the Nigerian context.

The study employed the non-experimental design of the survey research type. Purposive sampling was used to select the sample of the study based on the available students at the time of data collection. The sample was made up of three hundred and thirteen (313) final year undergraduates of the Department of Educational Technology, Tai Solarin University of Education, Ogun State, Nigeria. The sample was made up of 110 male and 203 female students. The distribution of the sample is shown in Table 1 below:

**Table 1:** Frequency distribution of the study's sample

<b>Gender</b>	<b>Frequency</b>	<b>Percentage</b>
Male	110	35.1
Female	203	64.9
<b>Total</b>	313	100
<b>Age</b>		
<20	42	13.4
21 - 25	248	79.2
26 - 30	22	7.0
31+	1	0.3
<b>Total</b>	313	100

An instrument developed using Google forms and titled “Technology-Generated Stress Questionnaire (CGSQ)”, with a Cronbach alpha reliability coefficient of .74, was used for data collection in the study. The instrument was also checked by two experts to ensure that it fits its purpose. Necessary corrections and adjustments were made where necessary. The instrument was made up of 12 items based on the objectives of the study, and the options given were based on the Likert scale of “Strongly disagree”, “Disagree”, “Agree”, and “Strongly Disagree”. The instrument was shared with the students online through their online platforms and was left open for two weeks during which the students attended to it. It was later closed for data collection after two weeks. The data collected through the online-based Google forms were collected and analyzed using Median (because the data collected was ordinal in nature - DeCoster et al. 2011; Jenkins & Gauvreau, 2006), Standard Deviation, T-test and ANOVA at a .05 level of significance. This was carried out using SPSS version 26.

## **RESULTS**

### **What is the perception of undergraduates on technology-influenced stress?**

The result in Table 2 reveals the perceptions of undergraduates on technology-influenced stress. According to the results, the students gave positive responses to the statements that staying long on the computer screen makes them feel stressed and exhausted (3.00); they are generally stressed if using computer screens for a longer period (3.00); restlessness begins to set in for them whenever their interaction with the computer screen is getting longer (3.00); and that they feel stressed if staying for



hours using a laptop or other bigger computer screens (3.00). However, the students reported that they do not feel stressed while on the computer screen if what they are doing is academically related (3.00). Based on the ranking of the Median scores from 1 to 4, it was concluded that the students have positive perceptions of technology-influenced stress, connoting that they are generally stressed when stung on the computer screens for long.

**Table 2:** Perceptions of undergraduates on technology-influenced stress

Statement	Median	S.D	Rank	Remark
Staying long on the computer screen makes me feel stressed and exhausted.	3.00	.791	1	Positive
Generally, I feel stressed if using computer screens for longer period of time.	3.00	.766	2	Positive
Restlessness begins to set in for me whenever my interaction with computer screen is getting longer.	3.00	.764	3	Positive
I feel stressed if staying for hours using laptop or other bigger computer screens.	3.00	.724	4	Positive
I don't feel any stress while on computer screen if what I am doing is academically related.	3.00	.666	5	Positive

**There is no significant difference in the perceptions of male and female undergraduates on technology-influenced stress.**

Results in Table 3 show no significant difference in the perceptions of male and female undergraduates on technology-influenced stress. According to the result ( $t\text{-cal} = 1.283 > p (.404) > 0.05$ ), both male and female undergraduates have the same positive perceptions of technology being able to influence stress when used constantly and for too long.

**Table 3:** T-test results on the perceptions of male and female undergraduates on technology-influenced stress

Perception	Variable	N	Mean	S.D	t-cal	t-tab	p-value	Remark
	Male	110	29.27	4.034	1.345	1.283	.404	Not Sig.
	Female	203	28.57	4.637				

Significant at  $p < 0.05$

**There is no significant difference in the perceptions of undergraduates on technology-influenced stress based on age.**

Results in Table 4 show no significant difference ( $F_{312} = .670 > p (.571) > 0.05$ ) in the perceptions of undergraduates on technology-influenced stress based on age. This shows that across age, undergraduates' positive perceptions of technology being able to influence stress among users did not differ.

**Table 4:** ANOVA result on the perceptions of undergraduates on technology-influenced stress based on age

<b>Perceptions of undergraduates on technology-influenced stress based on age</b>	<b>Sum of Squares</b>	<b>df</b>	<b>Mean Square</b>	<b>F</b>	<b>Sig.</b>
<b>Between Groups</b>	39.789	3	13.263	.670	.571
<b>Within Groups</b>	6113.463	309	19.785		
<b>Total</b>	6153.252	312			

Significant at  $p < 0.05$

## DISCUSSION

The study examined if human-computer interaction among university undergraduates can influence stress amongst them. The finding shows the affirmative. This is because the students reported that staying long on the computer screen makes them feel stressed, and exhausted, just as they are generally stressed if using computer screens for a longer period. They also reported the setting in of restlessness whenever their interactions with the computer screen are getting longer, among other complaints. This goes to show that as education globally transitions to almost fully online learning, there is the need to examine how students' continuous interactions with technology affect their mental wellbeing. Studies have shown that undergraduates experience different forms of stressors in their education experience, just as it has been reported that having to study and perform educational tasks under pressure, and working in a particular position [on computers] for prolonged periods among undergraduates have been found to correlate with anxiety, lower well-being, stress and reduction in concentration (Wennberg, 2016, cited in Dekker et al. 2020; Cant, 2018; Centre for Education Statistics and Evaluation, 2015). Also, technology-related stress presents strong evidence claiming that stressors emerging from technology usage (techno-stressors) influence stress reactions, and reduces an individual's well-being (Srivastava et al. 2015; Ayyagari et al. 2011). Therefore, students' reliance cum prolonged interaction with technologies are likely to trigger a high level of techno-stress (Jurek et al. 2021).

The study also reported that based on gender, no significant difference exists in undergraduates' perceptions of technology-influenced stress based on gender. This shows that concerning gender, the university undergraduates shared the same positive perceptions of technology's ability to influence stress among them when used constantly and for a longer time. Reports on techno-stress and gender have it that there exist differences in the amount of perceived technology-induced stress among students as the works of Maier et al (2014), Tarafdar et al. (2011), Ragu-Nathan et al. (2008), and Tarafdar et al (2007) reported that technology-induced stress is less common among females, compared with males (Fitzgerald, 2021). This is against the position of Currie et al. (2012), who reported that females were more likely to report technology-related stress compared to males. Corroborating Currie et al (2012), and Hess et al. (2006), cited in Kuurstra (2015), reported that females reported being more involved, compared with males. Finally, just as reported on gender, the study also reported no significant difference in the perceptions of undergraduates on technology-

influenced stress based on age. This connotes that age did not influence undergraduates' positive perceptions of technology-influenced stress among them. According to Thomée et al. (2010), there are high associations between high use of technology, in the realms of hours spent working on computers and smartphones per week, Internet surfing, and mental health issues among undergraduates aged 19 to 25 years (Thomée, et al. 2007).

## CONCLUSION AND RECOMMENDATIONS

In view of the findings of this study, it was concluded that technology can influence stress among undergraduates when used constantly and for longer periods. In an era where education is gradually transitioning to an almost online platform, undergraduates now stay on their devices for a longer time, especially in flipped and blended learning modes. There is, therefore, the need for stakeholders in education to examine this area of human-computer interaction, especially with regards to the social sciences and education in general to avert the danger of tampering with students' mental wellbeing in an attempt to ensure that they are learning using technology.

While the application of technology in education has many benefits, technology should not constitute problems to students' mental well-being because one of the main objectives of education is an effective learning outcome. This anticipated learning outcome might not be feasible or achievable if undergraduates are not prepared mentally, or are learning under constant stress as a result of the use of technology for learning. It, therefore, becomes imperative to come up with policies that will ensure that while students learn using technology, they are not unnecessarily stressed to the extent to which their mental wellbeing is negatively affected.

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