Perceived misinformation, disinformation and malinformation experience and the relationship with information overload

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Abstract

Background of the study: In today's digitally saturated world, individuals face cognitive overload due to the vast influx of information, including misinformation, disinformation, and malinformation.

Purpose: This study investigates the relationships between perceived experiences of misinformation, disinformation, and malinformation, and their impact on information overload among Malaysian students.

Method: Data were collected from 352 Malaysian students using a survey method and analyzed with Partial Least Squares Structural Equation Modeling (PLS-SEM). Participants reported their perceptions of misinformation, disinformation, malinformation experiences, and information overload on a Likert scale.

Findings: Results indicate that students experience moderate levels of misinformation, disinformation, and information overload, while malinformation was less prominent. Nevertheless, significant positive relationships were found between perceived misinformation, disinformation, and malinformation experiences, and information overload, suggesting that students encountering higher levels of these information types are more likely to experience cognitive overload.

Conclusion: This study underscores the challenges students face in processing vast amounts of information. It contributes to the theoretical understanding of how misinformation, disinformation, and malinformation contribute to information overload and emphasizes the need for promoting information literacy and critical thinking to mitigate these effects.

Keywords: Misinformation, disinformation, mal-information, information overload

Introduction

The advent of the information society has ushered in an era characterized by an unprecedented surge in the creation, storage, and dissemination of information. With the proliferation of digital technology, this process has been further accelerated, enabling individuals and organizations to generate vast amounts of data at an astonishing pace (Gams and Kolenik, 2021; Lee Ocepek and Makri, 2021). The exponential growth of information production reflects not only the advancement of technology but also the evolving needs and demands of users in an increasingly interconnected world (Nwagwu and Donkor, 2022). However, amidst this abundance of information lies a complex landscape fraught with challenges. The insatiable appetite for information has sometimes led creators to manipulate content for personal gain, giving rise to phenomena such as misinformation, disinformation, and malinformation (Aïmeur, Amri and Brassard, 2023). Lim (2023) study showed that the interest in the dissemination of false information is greater than its creation, with the task of ascertaining the intrinsic elements (e.g. maliciousness in disinformation and malinformation) being more challenging than that of extrinsic elements (e.g. truth of misinformation).

Both insufficient and excessive information can create significant challenges. While having too little information can lead to confusion and uncertainty, an overabundance of information can result in information overload, a phenomenon that is increasingly prevalent due to the vast volume and easy accessibility of data (Mahdi et al., 2020). When individuals are overwhelmed by too much information, it becomes increasingly difficult for them to distinguish between credible and false information (Arnold, Goldschmitt, and Rigotti, 2023). The root causes of information overload are varied and complex. They include the rapid pace of information production, the proliferation of digital platforms, and the lack of effective filtering mechanisms. Additionally, the constant bombardment of notifications, the pressure to stay updated, and the overwhelming amount of irrelevant or redundant information all contribute to this issue. Among these causes, information problems such as malinformation, misinformation, and disinformation could play a significant role, as they further complicate the process of identifying reliable information amidst the deluge of content (Balkan and Ülgen, 2023).

Past research has demonstrated that users, including students, encounter significant challenges related to malinformation, misinformation, and disinformation (Uddin et al., 2021; Isa, Samsudin, & Hendrawan, 2022; Yesmin, 2023; Hassan et al., 2023). Several studies have specifically focused on student populations in Malaysia (Isa, Samsudin, & Hendrawan, 2022; Hassan et al., 2023), highlighting the prevalence and impact of these information disorders within this demographic. However, these studies often examine each of these issues—misinformation, disinformation, and malinformation—independently, without addressing them collectively in a single, comprehensive study. This fragmented approach leaves a critical gap in understanding how these three forms of problematic information interact and influence the daily experiences of students. Furthermore, existing literature on misinformation, disinformation, and malinformation has predominantly concentrated on strategies to combat these challenges, primarily through the promotion of media and information literacy (Bran et al., 2021; Dame & Adjin-Tettey, 2022; Kačinová, 2020; Mrah, 2022; Ferrucci & Hopp, 2023; Foà et al., 2023; Heiss, Nanz, & Matthes, 2023; Yee & Huey Shyh, 2024; Xu, Huang, & Apuke, 2024; Lilja, Eklund, & Tottie, 2024; Adjin-Tettey & Amenaghawon, 2024). These studies consistently emphasize the vital role of media and information literacy in equipping users with the skills necessary to discern credible information from misleading or harmful content. While this focus is invaluable for developing countermeasures, it also suggests a gap in our understanding of how students actually experience these forms of misinformation, disinformation, and malinformation in their daily lives, particularly when all three are considered together. Given that the nature and impact of misinformation differ from those of malinformation and disinformation, it remains unclear to what extent students encounter and

differentiate these information problems when they are studied simultaneously. Understanding the combined influence of these three types of information disorders is crucial for developing more effective educational strategies and interventions tailored to the specific needs and challenges faced by students in navigating today's complex information landscape.

Research has consistently demonstrated that university students, including those from Malaysia, experience significant challenges related to information overload (AlHeneidi & Smith, 2021; Hassan & Al-Rejal, 2021; Hussain et al., 2021; Feroz et al., 2022; Afrilyasanti et al., 2023; Kusuma et al., 2023). These studies have identified various factors that contribute to information overload, highlighting how the overwhelming amount of information available to students can lead to difficulties in processing and making sense of this data. Among these contributing factors, misinformation has been specifically noted for its significant impact on information overload. Several studies have found a clear link between exposure to misinformation and the likelihood of experiencing information overload (Apuke et al., 2022; Wei, Yu, & Guo, 2023; Vivion et al., 2024). These findings suggest that as students encounter more misinformation, they are increasingly at risk of becoming overwhelmed by the sheer volume of information, leading to cognitive strain and reduced decision-making capabilities.

While the relationships between misinformation and disinformation and information overload have been explored, a significant gap remains in the literature concerning the role of malinformation in contributing to this phenomenon. Existing studies have predominantly focused on misinformation and disinformation, leaving unanswered questions about whether malinformation exerts a similar influence on information overload. Given that malinformation involves the deliberate use of truthful information to cause harm, it is plausible that it could exacerbate information overload in ways comparable to, or even more severe than, misinformation and disinformation.

This study seeks to address the abovementioned gaps by investigating how Malaysian university students perceive and assess their experiences with misinformation, disinformation, and malinformation, and by examining the combined influence of these experiences on perceived information overload. Specifically, the research questions guiding this study are: (i) How do Malaysian students perceive experiences of misinformation, disinformation, malinformation, and information overload? (ii) Do perceived experiences with misinformation, disinformation, and malinformation significantly influence information overload?

Literature Review
Theoretical Framework and Hypothesis Development

Media Richness Theory (MRT) (Daft and Langel, 1986) and Cognitive Load Theory (Sweller, 1988) both offer valuable theoretical frameworks for studying information overload in different contexts (Arnold, Goldschmitt, and Rigotti, 2023). MRT posits that communication channels vary in their ability to convey rich, nuanced information. Misinformation, disinformation, and malinformation may be transmitted through different media channels, each with varying levels of richness. For example, social media platforms may offer rapid dissemination of information but lack the depth and context provided by face-to-face interactions (Istiqomah, 2022; Khatimah, & Laksmi, 2019). As individuals navigate through diverse communication channels, they encounter information from different sources, each with varying degrees of credibility and richness. The richness of media influences individuals' ability to process and evaluate information, with richer media facilitating more nuanced understanding and interpretation. However, exposure to misinformation, disinformation, and malinformation across multiple media channels may overwhelm individuals' cognitive capacities, contributing to information overload. Therefore, media richness theory suggests that the proliferation of misinformation in diverse media environments can exacerbate cognitive strain and contribute to information overload among individuals.

According to cognitive load thoery, individuals have limited cognitive resources available for processing information. Perceived misinformation, disinformation, and malinformation experiences may impose cognitive demands by requiring individuals to evaluate the accuracy and credibility of information sources. As individuals encounter conflicting or misleading information, they must allocate cognitive resources to reconcile discrepancies and make informed judgments. This process of information evaluation and verification contributes to cognitive load, potentially leading to information overload when cognitive resources are overwhelmed. Thus, cognitive load theory suggests that higher levels of perceived misinformation, disinformation, and malinformation experiences are associated with increased cognitive load, leading to information overload.

Figure 1 depicts the theoretical framework developed for the study. The dependent variable is the information overload, while the independent variables are perceived misinformation experience, perceived disinformation experience and perceived malinformation experience.
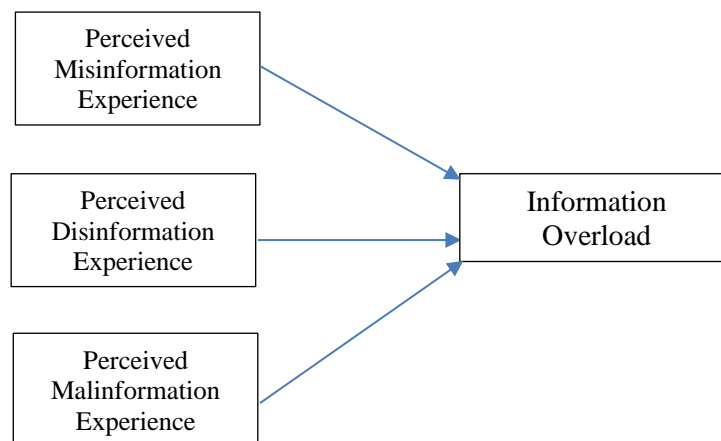
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┌─────────────────┐
│   Perceived     │
│  Misinformation │──────────┐
│   Experience    │          │
└─────────────────┘          ▼
┌─────────────────┐   ┌─────────────────┐
│   Perceived     │   │   Information   │
│  Disinformation │──▶│    Overload     │
│   Experience    │   │                 │
└─────────────────┘   └─────────────────┘
┌─────────────────┐          ▲
│   Perceived     │          │
│  Malinformation │──────────┘
│   Experience    │
└─────────────────┘
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Figure 1: Theoretical Framework

Gradoń et al. (2021) build upon the work of Wardle (2018) and Wardle and Derakhshan (2017) to explain the three categories of information disorder: misinformation, disinformation, and malinformation. Misinformation refers to information that is false but not necessarily distributed with malicious intent. Often, individuals unknowingly propagate misinformation, believing it to be true and sharing it on social media platforms in an attempt to be helpful. The dissemination of misinformation can occur innocently, yet it still contributes to the distortion of truth within the informational landscape. Gurgun et al. (2024) study showed that, in a social media context, users are generally hesitant to challenge misinformation. Apuke et al. (2024) on the other hand discovered that social tie strength, virality, social media usage intensity and fun all predicted misinformation circulation. Conversely, trust in social networking site (SNS) and parasocial interaction were not found to be related to misinformation spreading.

In contrast, disinformation is characterized as deliberately fabricated or disseminated false information with the explicit aim of causing harm. Those responsible for generating disinformation often harbor political, financial, psychological, or social motivations, utilizing deceit as a tool to manipulate perceptions or sow discord within society (Karyotakis, 2023; Paličková and Černoch, 2024; Deschrijver, 2024). Arce (2024) asserted that disinformation is a form of offensive counterintelligence via deception and neutralization in order to strategically manipulate an audience or create further fractures in existing divisions. Arce (2024) further elaborated that disinformation strategies include leaking, lying, seeding, and smearing and these

strategies vary according to whether the information conveyed is true or false, and whether the source uses or hides its identity. According to Dragomir, Rúas-Araújo and Horowitz (2024), disinformation is not limited to global platforms or the internet, traditional media outlets in many European countries also act as vehicles of disinformation often under the direction of the government.

Additionally, malinformation encompasses the sharing of genuine information with the specific intention of causing harm. This category includes the deliberate dissemination of private or sensitive information aimed at damaging an individual's reputation or causing personal harm. Unlike disinformation, malinformation relies on the weaponization of truthful content to achieve its harmful objectives.

Information Overload

According to Koltay (2017) information overload is common in the following settings: (i) in academia, impacting faculty, researchers and students (ii) in business environments impacting the employees (decision makers and other members) and customers. Koltay (2017) also explained that information overload is not caused by a single factor, but has several causes that influence two fundamental variables. The first variable is information processing capacity, which is a personal characteristic while the second variable is determined by the nature of the task or process (Koltay, 2017). If an individual is capable to process only a smaller amount of information than required in the determined timeframe, information overload is present (Belabbes et al., 2023).

Studies have also shown that the quality and quantity (i.e. amount) of information received by individual do have bearing on information overload. Graf and Antoni (2021) conducted a meta-analysis and found a significant correlation between overall information characteristics (i.e. quality) and information overload. Arnold, Goldschmitt, and Rigotti (2023) asserted that the quality of information includes the various aspects that contribute to the fit of the information to the needs of the person receiving it. However, the subjective assessment of the quantity of information may be influenced by the available resources (Arnold, Goldschmitt, and Rigotti, 2023). Agharazidermani (2021) found that information consumption from both credible and non-credible sources had a significant relationship with information overload and eHealth literacy. Zhang et al., (2020) conducted a field survey of 244 WeChat users and found that the amount of information received and the length of content increased users' perceptions of information overload.

The internet and social media have profoundly impacted the amount of information available to users, leading to an exponential increase in data consumption (Hussain and Soomro, 2023). With the widespread use of mobile gadgets, this influx of information has only accelerated, providing users with unprecedented speed and quantity of data. However, amidst this abundance, not all information shared meets the necessary quality standards. The perception of received information hinges on an individual's discernment, which is influenced by their abilities and level of intelligence.

For individuals with a certain level of knowledge, differentiating between credible and non-credible information comes more naturally. University students, for instance, typically possess foundational skills to discern between reliable and unreliable sources (Colussi et al., 2024; Gurgun et al. 2024). They are equipped with the necessary competencies to identify misinformation, malinformation, or disinformation, safeguarding themselves from potential harm associated with information disorders. Despite these capabilities, however, they are not immune to the challenges posed by the sheer volume of misleading information they encounter, leading to a phenomenon known as information overload (Li, Gao and Ye, 2023; Hong et al., 2023).
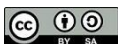
Perceived Misinformation Experience

Perceived misinformation experience can be operationally defined as an individual's subjective perception of encountering false or inaccurate information that is unintentionally spread (Wardle and Derakhshan, 2017). This perception can stem from various sources, such as misleading headlines, doctored images, or viral rumors. For example, imagine a university student scrolling through their social media feed and coming across a sensationalized headline claiming a breakthrough in a medical study. Despite the lack of credible sources or scientific evidence, the student may perceive this information as valid due to its widespread dissemination, leading to a potential misinformation experience.

Moreover, the proliferation of misinformation across multiple platforms can exacerbate the problem of information overload. For instance, consider a scenario where a student receives conflicting information about a current event from different sources, such as news websites, social media posts, and online forums. Attempting to navigate through this barrage of contradictory information can overwhelm the student, causing confusion and cognitive fatigue. As they grapple with discerning the truth from falsehoods, their mental bandwidth becomes strained, contributing to the phenomenon of information overload. This is supported by research conducted by Wei, Yu, and Guo (2021) who examined the relationship between COVID-19 misinformation and information overload and avoidance during the late stage of the global COVID-19 pandemic. The results from the telephone survey in Beijing, Hong Kong, Singapore, and Taipei show that exposure to both information and misinformation about the pandemic was significantly related to the mental state of overload.

H1: There is a significant positive relationship between perceived misinformation experience and information overload

Perceived Disinformation Experience

At its core, disinformation—the deliberate spreading of mistruths to deceive—is about psychological manipulation (Khari, 2023). By distorting the truth, disinformation is a weapon that can shake financial markets, damage organizational and individual reputations, undermine democratic elections, fuel conflicts and cost lives (Khari, 2023). Perceived disinformation experience can be operationally defined as an individual's subjective perception of encountering intentionally false or misleading information disseminated with the intent to deceive or manipulate (Wardle and Derakhshan, 2017).

Through an online survey involving a representative sample of 1,015 adult participants in Tandoc and Seet (2022) found that participants who saw the term "fake news" reported the highest level of perceptions of falsity and intentionality. The term "fake news" also elicited the highest level of concern, perceived severity, and treatment recommendation, although the terms "misinformation" and "online falsehoods" also displayed similar levels, while "disinformation" elicited the lowest ratings. One example of disinformation leading to information overload among university students is evident in the spread of false narratives surrounding COVID-19 origins (Posetti and Bontcheva, 2020; Baerg and Bruchmann, 2022). During the early stages of the pandemic, various disinformation campaigns circulated online, suggesting that the virus was intentionally created or released from a laboratory (Su, 2021). These false claims, amplified through social media platforms and fringe websites, led to widespread confusion and speculation among university students. Moreover, the persistence and amplification of COVID-19 disinformation across various online platforms further exacerbated the problem of information overload among students (Uddin et al., 2021).

H2: There is a significant positive relationship between perceived disinformation experience and information overload

Perceived Malinformation Experience

Unlike misinformation and disinformation, malinformation does not depend on false information, but instead leverages plausible and accurate—or at least arguably accurate—information presented either without context or in an incorrect context to lead those encountering it to false or misleading impressions and conclusions (Grimes and Gorski, 2022). According to Affelt (2022), malinformation often combines misinformation and disinformation to generate an entirely new supposition, creating mental whiplash as the content consumer ingests factual information that, perhaps, they already knew to be true and then continues reading the additional information that surrounds that fact but is false.

Perceived malinformation experience is concerned with an individual's subjective perception of encountering true but harmful information disseminated without consent or with malicious intent (Wardle and Derakhshan, 2017). This can encompass various forms of content, including personal data leaks, revenge porn, or the deliberate spread of sensitive information with the aim of causing harm or distress. For example, consider a scenario where an individual's private messages or compromising photos are shared online without their consent, leading to humiliation and emotional distress. In such cases, the dissemination of true yet harmful information constitutes malinformation, as it violates the individual's privacy rights and inflicts psychological harm (Muntiah, & Dewi, 2023). Moreover, the deliberate intent behind the dissemination of such content distinguishes malinformation from inadvertent sharing of information, highlighting the malicious nature of the act.

Perceived malinformation experience can lead to information overload among university students by subjecting them to distressing or harmful content, such as personal data leaks or revenge porn, which not only causes cognitive strain but also undermines their ability to focus on academic tasks and discern credible information amidst the influx of misleading narratives (Jacobfeuerborn and Muraszkiewicz, 2013; Tanaś, 2021). Yesmin (2023) study found a positive correlation among gender, study level, and frequency of using Internet and social media with familiarity with misinformation, disinformation, fake news, rumor, and malinformation.

H3: There is a significant positive relationship between perceived malinformation experience and information overload

Method

Instrument Development

The study employed a survey research methodology, utilizing an online questionnaire as the primary instrument for data collection. The instrument employed to measure information overload was adapted from the work of Williamson, Eaker, and Lounsbury (2012), comprising 15 items presented in the form of perceptual measures. Respondents were requested to indicate their level of agreement using a five-point Likert scale, ranging from 1 for "strongly disagree" to 5 for "strongly agree." Furthermore, instruments measuring perceived misinformation, perceived disinformation, and perceived malinformation were self-developed, drawing upon definitions provided by Wardle and Derakhshan (2017) and Gradon et al. (2021). Each of these variables was assessed using five items presented as perceptual measures. Respondents were instructed to select the most relevant option from a Likert scale labelled as 1 for "never" to 5 for "always." The utilization of distinct labelling for Likert scale points aimed to mitigate the potential issue of common method bias (Masrek and Heriyanto, 2021). Prior to the main data collection phase, the questionnaire underwent pre-testing and pilot testing to ensure adherence to quality standards in terms of reliability and validity. Feedback from two senior academicians

was incorporated into the refinement of the questionnaire. A pilot test involving 30 students was conducted, and their responses were analyzed to assess the Cronbach's Alpha score. The results indicated that the scores exceeded the benchmark value of 0.7, affirming the reliability of the questionnaire.

Population, Sampling and Sample Size

The study's population comprises university students enrolled in Malaysian universities. However, due to confidentiality constraints precluding access to a sampling frame, the adoption of any form of probability sampling is unfeasible. Consequently, the study employs convenient sampling, a non-probability sampling technique wherein researchers select participants based on their accessibility and proximity. This approach aligns with Hulland, Baumgartner, and Smith (2017) assertion that non-probability sampling is well-suited for testing theoretical assumptions rather than generalizing findings to broader populations. Additionally, Bryman and Bell (2015) underscore the common application of non-probability sampling in fieldwork research. In determining the required sample size, the study adopts the guideline established by Kline (2015), given its utilization of partial least squares structural equation modeling for data analysis. Kline (2015) recommends a sample size of 200 or more for complex models characterized by non-normal distributions. The study successfully collects 352 responses, surpassing Kline's guideline, thus ensuring robustness in statistical analysis and model evaluation.

Data Collection

Representatives from various private and public universities served as intermediaries for data collection in this study. They were tasked with disseminating the survey invitation to students within their respective institutions via popular social media platforms, including WhatsApp, Telegram, and Facebook Messenger. The online questionnaire was developed using the SurveyMonkey platform to facilitate data collection. The data collection phase spanned nearly 10 weeks, during which weekly reminders were issued to the representatives to actively promote and encourage student participation. Upon conclusion of the data collection period, a total of 372 responses were received. However, during the data validation process, it was discovered that 20 responses had to be excluded due to the absence of responses for more than 50% of the questionnaire items.

Data Analysis

Given that the study addresses two primary research questions, distinct analytical methods were employed to address each inquiry. Descriptive statistics were utilized to analyze the research variables in response to the first research question. This entailed executing a descriptive analysis using SPSS Version 24.0, focusing on mean scores and standard deviations. To address the second research question, Partial Least Squares Structural Equation Modeling (PLS-SEM) was employed (Hair et al., 2018). This analytical approach was selected due to the exploratory nature of the relationship between variables and the non-normal distribution of the obtained data, rendering PLS-SEM highly appropriate for this context. The PLS-SEM analysis unfolded in two essential stages. Initially, the measurement model was evaluated, assessing both convergent and discriminant validity. Convergent validity scrutinized the extent to which items measuring a specific construct demonstrated strong interrelations, while discriminant validity explored the distinctiveness of items measuring different constructs. Subsequently, attention shifted to the evaluation of the structural model, which delved into the hypothesized relationships between the variables. In this investigation, the structural model meticulously examined the interrelationships among the constructs under scrutiny.

Result and Discussion

Common Method Bias

Podsakoff et al. (2003) emphasized that common method bias is a critical issue that may compromise the reliability and validity of research results. Common method bias can be mitigated through procedural and statistical methods (Tehseen, Ramayah, and Sajilan, 2017). In this study, we employed both approaches. Procedurally, we utilized distinct labeling for both independent and dependent variables. For statistical validation, we employed the Harman single-factor test. All 30 items, including 5 items each measuring perceived misinformation experience, perceived disinformation experience, perceived malinformation experience, and 15 items measuring information overload, were aggregated and subjected to a single factor analysis. The resulting total extracted variance was 34.1%, indicating minimal common method variance. This outcome aligns with the recommendations of the Harman single-factor test.

Demographic

Table 1 provides a comprehensive overview of the demographic characteristics of the respondents. Among the 352 participants, a significant majority, constituting 72.4%, identified as female, a trend commonly observed within Malaysian university settings. Regarding age distribution, the largest proportion, accounting for 88.1% of respondents, fell within the 20 to 29 age bracket, with a notable 6% representing individuals aged between 40 and 49. In terms of academic program enrollment, the majority (78.7%) were pursuing Bachelor's degrees, while a smaller segment (4.5%) reported undertaking PhD studies. Analysis further reveals that a considerable portion of participants identified themselves as being in semester 1 of their academic journey (31.8%), followed by those in semester 3 (15.9%) and semester 5 (12.8%). Notably, there was nearly an equal distribution between Year 1 and Year 2, with 33.2% and 33.5% respectively. Additionally, the field of study indicated by respondents predominantly lies within the realm of social science and management (82.1%), with a notable minority pursuing studies in engineering and technology (13.1%).

Tabel 1. Demographic Details of Respondents

		Frequency	Percent
Gender	Male	97	27.6
	Female	255	72.4
Age	20 - 29 year	310	88.1
	30 - 39 year	20	5.7
	40 - 49 year	21	6.0
	60 or above	1	.3
Program Level	Diploma	23	6.5
	Degree	277	78.7
	Master	36	10.2
	PhD	16	4.5
Semester of Study	Semester 1	112	31.8
	Semester 2	36	10.2
	Semester 3	56	15.9
	Semester 4	40	11.4
	Semester 5	45	12.8
	Semester 6	32	9.1
	Semester 7	26	7.4

Year of Study / Field of Study		Count	Percent
	Semester 8	2	.6
	Semester 9	1	.3
	Semester 10	2	.6
Year of Study	Year 1	117	33.2
	Year 2	118	33.5
	Year 3	94	26.7
	Year 4	19	5.4
	Year 5	2	.6
	Year 6	2	.6
Field of Study	Engineering and Technology (e.g. Electrical, Mechanical, Civil, Computer Science, Data Science etc)	47	13.4
	Health Sciences (e.g. Medical, Dentistry, Pharmacy etc)	4	1.1
	Social Sciences and Management (e.g. Information Management, Accounting, Human Resources)	289	82.1
	Arts and Humanities (Music, Arts, Religion etc)	12	3.4

Descriptive Analysis of Research Variables

The assessment of information overload was conducted utilizing a Likert scale comprising five points, each representing varying degrees of agreement. Specifically, respondents were prompted to indicate their level of agreement with statements on a scale where 1 denoted "strongly disagree" and 5 signified "strongly agree." Upon analysis, the overall mean score for information overload was determined to be 3.52 (Table 2), indicating a moderate level of agreement among participants. This mean score suggests that, on average, respondents leaned towards agreement regarding the presence of information overload in their daily experiences, highlighting the prevalence of this phenomenon within the studied context.

In contrast, the evaluation of perceived misinformation, disinformation, and malinformation experiences involved five distinct items for each category, employing a Likert scale with labels ranging from 1 to 5. Respondents were tasked with indicating the frequency of their experiences, with 1 representing "never" and 5 corresponding to "always." The mean scores for perceived misinformation, disinformation, and malinformation experiences were calculated as 3.11, 3.09, and 2.97, respectively. These findings suggest that respondents reported experiencing perceived misinformation most frequently, followed by perceived disinformation and malinformation experiences. The relatively lower mean score for malinformation experience indicates that respondents encountered such instances less frequently compared to misinformation and disinformation, shedding light on the varied nature of information-related challenges faced by individuals within the studied population.

Table 2. Descriptive Analysis of Information Overload

Items	Mean	Std. Deviation
Information Overload	3.52	0.845
Perceived Misinformation Experience	3.11	0.893
Perceived Disinformation Experience	3.09	0.894
Perceived Malinformation Experience	2.97	0.953

Measurement Model Assessment

The assessment of the measurement model encompasses both convergent and

discriminant validity. Convergent validity gauges the consistency of various measurement methods in capturing the same underlying concept, while factor loading delineates the strength of the relationship between an observed variable and its latent factor in factor analysis. Additionally, composite reliability evaluates the internal consistency of a latent construct composed of multiple observed variables, and Average Variance Extracted (AVE) quantifies the proportion of variance captured by a latent construct relative to measurement error.

Table 3 presents the evaluation of the measurement model for the research variables, including information overload, perceived misinformation experience, perceived disinformation experience, and perceived malinformation experience. While conventional guidelines recommend factor loadings above 0.708, Ramayah et al. (2018) suggest a threshold of 0.5, provided that the Construct Reliability (CR) and AVE exceed 0.7 and 0.5, respectively. Notably, all factor loadings in our study surpass 0.5, and the composite reliability values for all constructs comfortably exceed 0.7. Similarly, the AVE scores for all constructs surpass 0.5. Based on these findings, we can confidently assert the convergent validity of the constructs.

Table 3. Assessment of Convergent Validity

	Item Code	Items	Factor Loading	Composite Reliability	Average Variance Extracted
Information Overload	InfoOvld1	I have to manage so much information in my daily life that it takes me a long time to complete even simple tasks.	0.694		
	InfoOvld2	I regularly feel overwhelmed by too much information these days.	0.848		
	InfoOvld3	It is sometimes hard for me to concentrate because of all the information I have to assimilate.	0.695		
	InfoOvld4	There is so much information available on topics of interest to me that I have trouble choosing what is important and what's not.	0.690		
	InfoOvld5	I have to process so much information that it frequently takes me too long to get things done in a timely manner	0.696	0.937	0.501
	InfoOvld6	I feel overwhelmed learning a new subject or topic because there is so much information.	0.685		
	InfoOvld7	I am confronted by an avalanche of Email, phone and text messages each day.	0.691		
	InfoOvld8	When I search for information on a topic of interest to me, I usually get too much rather than too little information.	0.693		
	InfoOvld9	I have so much information to manage on a daily basis that it is hard for me to prioritize tasks.	0.702		
	InfoOvld10	I am stressed out by the sheer volume of information I have to manage on a daily basis.	0.686		

	InfoOvld11	It seems like the volume of information available is increasing exponentially in a relatively short period of time.	0.683		
	InfoOvld12	I feel like I can't keep up with all the new developments in my area of expertise.	0.706		
	InfoOvld13	I sometimes feel numb and incapable of action because of all the information I have to process on a daily basis.	0.694		
	InfoOvld14	I feel like my attention span is becoming shorter and shorter because of information overload.	0.722		
	InfoOvld15	I regularly feel pressed for time because of all the information I have to deal with.	0.712		
Perceived misinformation experience	MisInfo1	... false information about current events or news topics?	0.780		
	MisInfo2	... fake information about health-related issues or medical treatments?	0.766		
	MisInfo3	... inaccurate information about political candidates or election-related matters?	0.742	0.84	0.514
	MisInfo4	... misleading information about product advertisements or consumer reviews?	0.583		
	MisInfo5	... incorrect information about scientific discoveries or research findings?	0.696		
Perceived disinformation experience	DisInfo1	... intentionally false information about political events or government policies?	0.664		
	DisInfo2	... fabricated information about social issues or cultural controversies?	0.743		
	DisInfo3	... deceptive information about corporate products or business practices?	0.789	0.858	0.547
	DisInfo4	... manipulated information about historical events or conspiracy theories?	0.781		
	DisInfo5	... false information about environmental issues or climate change?	0.716		
Perceived malinformation experience	MalInfo1	…. true but harmful information about personal data breaches or privacy violations?	0.651		
	MalInfo2	…. damaging information about individuals or organizations without their consent?	0.754		
	MalInfo3	…. private information about celebrities or public figures leaked online?	0.776	0.839	0.513
	MalInfo4	…. sensitive information about legal matters or confidential documents made public?	0.790		
	MalInfo5	…. harmful rumors or gossip about yourself or others circulating online?	0.589		

Discriminant validity refers to the extent to which a construct is distinct from other

constructs in a measurement model. In assessing discriminant validity, the Heterotrait-Monotrait (HTMT) ratio of correlations is commonly used, where the HTMT should ideally be below a certain threshold to confirm the distinctiveness of constructs. A common threshold suggested in the literature is 0.85 (Kline, 2015), indicating that the correlations between different constructs should not exceed this value to ensure discriminant validity. In our analysis, all cells in the HTMT matrix score less than 0.85, affirming the discriminant validity of the constructs in our measurement model.

Table 4. Assessment of Discriminant Validity

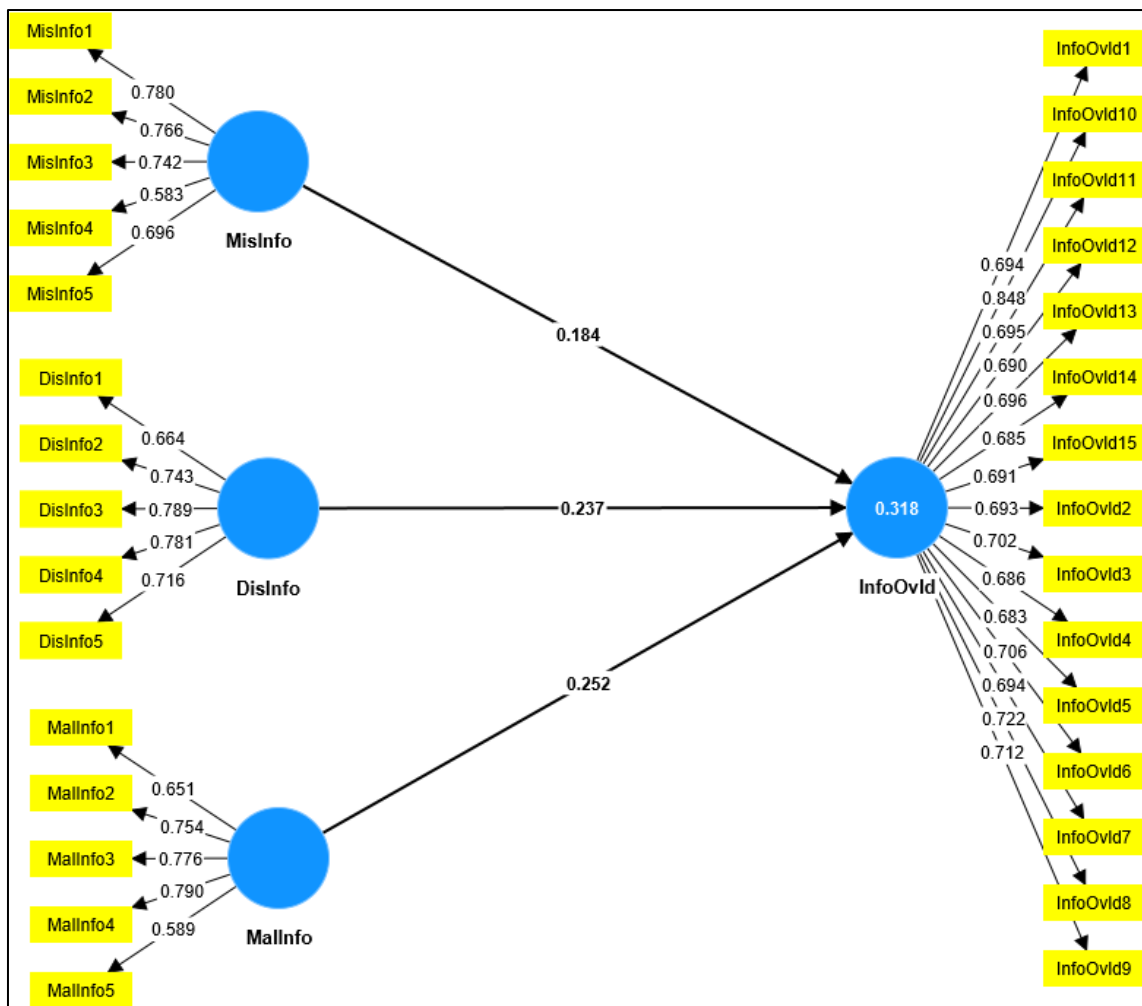|	Perceived disinformation experience	Information Overload	Perceived malinformation experience	Perceived misinformation experience
Perceived disinformation experience				
Information Overload	0.562			
Perceived malinformation experience	0.716	0.546		
Perceived misinformation experience	0.820	0.529	0.611	

Figure 2. SmartPLS output of the measurement model

Structural Model Assessment

The analysis of the structural model relies on the bootstrapping procedure. To interpret the results, researchers have adopted a guideline based on significance levels, where hypotheses are considered supported when p-values fall below 0.01 (t>1.645), 0.05 (t>1.96), or 0.001 (t>2.58). The findings, as depicted in Table 5, indicate that all hypotheses, namely H1, H2, and H3, are accepted. Additionally, researchers conducted Variance Inflation Factor (VIF) analysis to detect excessive correlations among variables. The outcomes reveal the absence of multicollinearity, with VIF values below the threshold of 3.3. The predictive relevance of the model was assessed by calculating the R2 value, which stands at 0.318, implying moderate predictive relevance. Additionally, an assessment of the "effect size" was conducted to gauge the magnitude of associations between independent and dependent variables within the model. Following the guidelines established by Cohen (1988), effect sizes were classified into three categories: large (≥0.35), moderate (0.15 to 0.349), or small (≤0.03). The findings, as depicted in Table 5, demonstrate small effect sizes across all relationships.
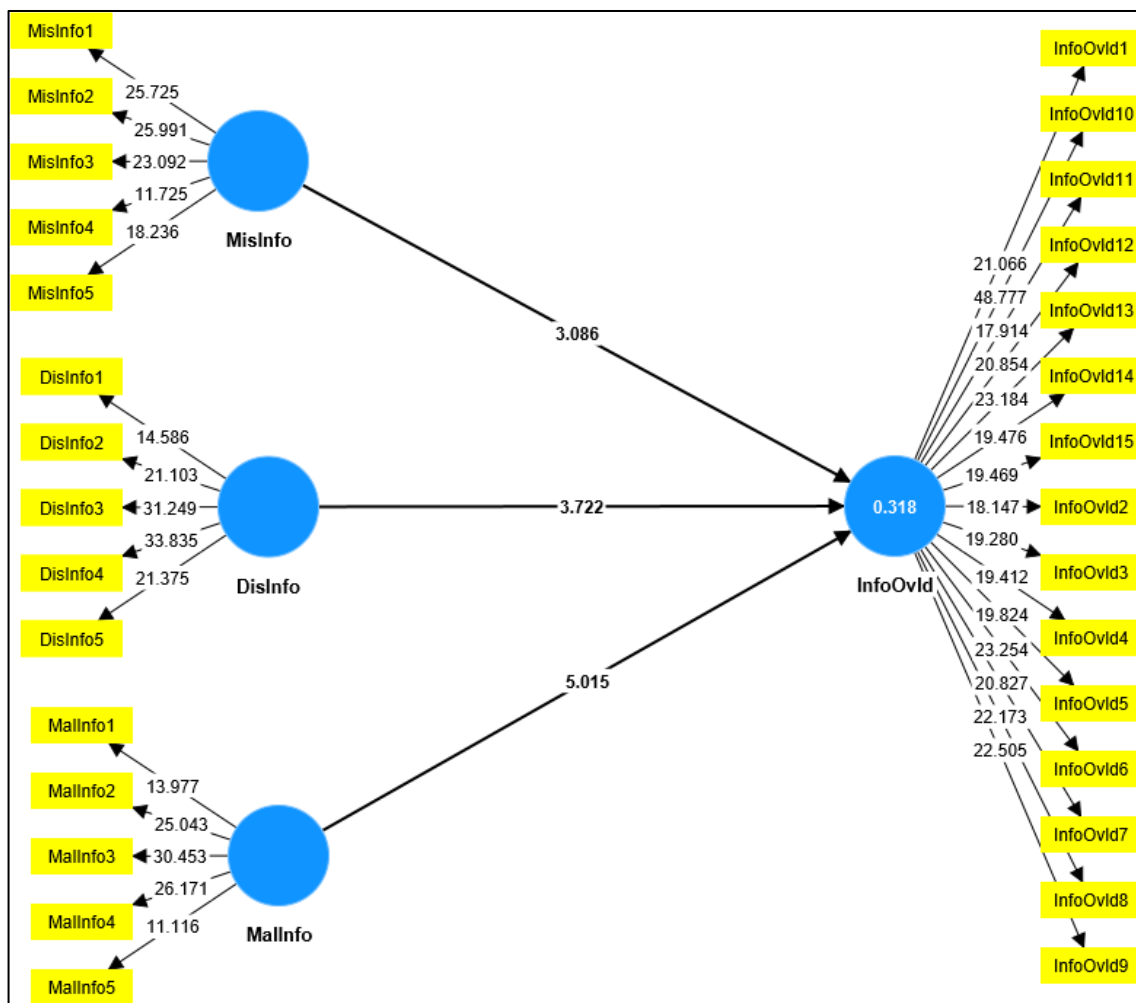

Figure 3. SmartPLS output of the structural model

Table 5. Results of the Structural Model Assessment

	β	T value	P values	VIF	F square	R square
H1: Perceived misinformation experience → information overload	0.184	3.086	0.001	1.683	0.030	0.318
H2: Perceived disinformation experience → information overload	0.237	3.722	0.000	1.958	0.042	
H3: Perceived malinformation experience → information overload	0.252	5.015	0.000	1.504	0.062	

Discussion

Discussion Related to First Research Questions

The findings indicate that Malaysian university students report relatively moderate levels of perceived experiences with misinformation (M = 3.11), disinformation (M = 3.09), and malinformation (M = 2.97) on a 5-point Likert scale. These results suggest that while students are encountering all three types of problematic information, misinformation and disinformation are perceived to be more prevalent or impactful than malinformation. These findings are consistent with previous research, which has documented that users, including students, face significant challenges related to misinformation, disinformation, and malinformation (Uddin et al., 2021; Isa, Samsudin, & Hendrawan, 2022; Yesmin, 2023; Hassan et al., 2023). The relatively similar levels of perceived misinformation and disinformation experiences align with these studies, which have often highlighted the widespread and persistent nature of these issues in digital and social media environments.

The slightly lower perception of malinformation could be attributed to several plausible factors. One possible justification for the lower perceived experience of malinformation is that it is often more subtle and less immediately recognizable than misinformation or disinformation. While misinformation and disinformation are typically characterized by clear falsehoods or deceptive intentions, malinformation involves the dissemination of truthful information used with the intent to cause harm. This might make malinformation less conspicuous to students, who may not always recognize the harmful intent behind such content, especially when it is presented as factual or accurate. Additionally, the specific contexts in which malinformation is most damaging—such as targeted harassment, or the intentional spread of harmful truths—may not be as prevalent in the everyday experiences of students compared to the more ubiquitous nature of misinformation and disinformation. Another factor could be the emphasis in media and information literacy education, which tends to focus more on identifying and combating misinformation and disinformation, potentially leading to greater awareness of these issues among students. As a result, students may be more attuned to recognizing misinformation and disinformation, while the more nuanced and context-dependent nature of malinformation might not be as easily identifiable.

The findings reveal that the perceived level of information overload among Malaysian university students is moderately high, with a mean score of 3.52 on a 5-point Likert scale. This suggests that students frequently experience a significant sense of being overwhelmed by the volume of information they encounter in both their academic and daily lives. These results align with and support previous research on information overload, as highlighted in studies by AlHeneidi and Smith (2021), Hassan and Al-Rejal (2021), Hussain et al. (2021), Feroz et al. (2022), Afrilyasanti et al. (2023), and Kusuma et al. (2023). These studies consistently emphasize the prevalence of information overload among university students, particularly in the context of the increasing accessibility and volume of information driven by digital platforms and social media. The findings from our study resonate with these earlier works, underscoring that despite efforts to equip students with media and information literacy skills, the sheer

volume and complexity of information they must navigate continues to pose a significant challenge.

Discussion Related to Second Research Questions

To address our second research question, we formulated three hypotheses, all of which were supported by our findings. The beta coefficients—0.184 for misinformation, 0.237 for disinformation, and 0.252 for malinformation—demonstrate that each type of problematic information significantly contributes to the experience of information overload. These results are consistent with prior studies that have examined the impact of misinformation on information overload (Apuke et al., 2022; Wei, Yu, & Guo, 2023; Vivion et al., 2024). The positive relationship between misinformation and information overload is well-established, as misinformation overwhelms users with false or misleading content, complicating their ability to process and discern credible sources. Our findings extend this understanding to disinformation, corroborating the work of Posetti and Bontcheva (2020) and Baerg and Bruchmann (2022), who have underscored the disruptive effects of these harmful forms of information on cognitive processing.

Interestingly, despite the relatively lower perceived experience of malinformation (with a mean score of 2.97 on a 5-point Likert scale), it still emerged as a significant predictor of information overload, with the highest beta coefficient of 0.252. This suggests that even though students report encountering malinformation less frequently than misinformation or disinformation, its impact on information overload is particularly pronounced. Several plausible reasons could explain these findings. First, disinformation, by its very nature, is crafted with the intent to deceive, often using sophisticated methods to obscure the truth and manipulate perceptions. This intentional deceit can lead to greater cognitive dissonance as users struggle to reconcile conflicting information, exacerbating their sense of overload. The deliberate creation and spread of disinformation, particularly in environments where trust in information sources is already fragile, can overwhelm users' cognitive resources, making it more difficult to process and filter information effectively. Second, malinformation, which involves the dissemination of truthful information intended to cause harm, may have a particularly insidious impact on information overload. The harmful intent behind malinformation can heighten emotional responses, such as anxiety or distress, which can further cloud judgment and hinder cognitive processing. When users are confronted with malinformation, the emotional and psychological burden may amplify the feeling of being overwhelmed, as they not only have to process the information itself but also contend with the underlying harmful intent. Thirdly, both disinformation and malinformation often exploit existing fears, biases, or social tensions, making them more salient and harder to ignore. This increased salience can lead to a heightened focus on these types of information, further contributing to cognitive overload. The user's mental resources are consumed not only by the sheer volume of content but also by the effort required to navigate and mitigate the potential harms posed by these more targeted and intentional forms of information disorder.

Conclusion
Theoretical Contribution

The present study makes a significant theoretical contribution by elucidating the relationships between perceived misinformation, disinformation, and malinformation experiences, and information overload. One of the key contributions lies in bridging the gap in existing literature by exploring the interconnectedness of these constructs within a comprehensive model. While previous studies have examined each construct in isolation, there remains a dearth of research that integrates these variables into a unified framework. By

establishing a model that connects perceived misinformation, disinformation, and malinformation experiences with information overload, this study offers valuable insights into the cognitive processes involved in navigating an information-rich environment. This contributes to the broader theoretical discourse on information processing and cognitive load, shedding light on the factors that contribute to individuals' experiences of cognitive overwhelm in the digital age. Moreover, it strengthens the foundations of Media Richness Theory and Cognitive Load Theory, further enriching our understanding of information overload dynamics.

Practical Contribution

The findings of this study offer several practical implications for individuals, organizations, and policymakers grappling with the challenges posed by misinformation and information overload in today's digital landscape. Firstly, the identification of significant relationships between perceived misinformation, disinformation, and malinformation experiences, and information overload underscores the importance of promoting information literacy and critical thinking skills among the general populace. By equipping individuals with the ability to discern credible information from misleading sources, interventions can empower them to navigate the information environment more effectively and mitigate the negative effects of misinformation on cognitive load.

Secondly, the insights provided by this study can inform the development of targeted interventions and educational programs aimed at enhancing media literacy and digital literacy skills. By raising awareness about the prevalence and impact of misinformation, disinformation, and malinformation, organizations and educational institutions can empower individuals to critically evaluate information sources, identify misinformation cues, and adopt strategies to mitigate information overload. These interventions can be tailored to different demographic groups and contexts to address specific information needs and challenges effectively.

The findings of this study highlight the importance of fostering a culture of responsible information consumption and sharing within organizations and communities. By promoting transparency, accountability, and ethical information practices, organizations can cultivate an environment where accurate and reliable information is valued and misinformation is challenged. This can help mitigate the spread of misinformation and disinformation within organizational settings and contribute to building trust and credibility among stakeholders.

Policymakers can use the insights gleaned from this study to inform the design of regulations and policies aimed at combating misinformation and enhancing information integrity. By addressing the underlying factors contributing to information overload, such as the proliferation of misinformation and the lack of effective information management strategies, policymakers can create a more resilient information ecosystem that safeguards against the adverse effects of misinformation on individuals' cognitive well-being and societal cohesion.

Limitation and Suggestion for Future Research

Despite the valuable insights provided by this study, several limitations should be acknowledged. Firstly, the study relied on self-reported measures of perceived misinformation, disinformation, and malinformation experiences, as well as information overload. This may introduce common method bias and social desirability bias, potentially influencing the accuracy of responses and the validity of the findings. Future research could mitigate these limitations by employing mixed-method approaches or incorporating objective measures of information consumption and cognitive load.

Secondly, the study adopted a cross-sectional design, which limits our ability to infer causality or temporal relationships between the variables examined. Longitudinal studies or experimental designs could provide more robust evidence of the causal pathways linking

perceived misinformation, disinformation, and malinformation experiences with information overload over time.

Thirdly, the study focused on a specific population or context, which may limit the generalizability of the findings to other populations or settings. Future research could explore the relationships examined in this study across diverse demographic groups, cultural contexts, and information environments to enhance the external validity of the findings.

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Authors' Contributions

All authors have contributed to the final manuscript. The contribution of all authors: conceptualization, methodology, formal analysis, writing original draft preparation, writing review and editing. All authors have read and agreed to the published version of the manuscript.

Conflict of Interest

All authors have no conflict of interest related to this study.

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