Optimizing Web Surveys in Research: Methodological Considerations and Validity Aspects

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ABSTRACT

Web surveys are a data collection method where surveys or questionnaires are sent over the internet to a sample of respondents, and they can respond to this survey over the World Wide Web. Web surveys have become increasingly prevalent in research due to their convenience, cost-effectiveness, and broad reach. However, ensuring web surveys' methodological rigor and validity is crucial for generating reliable findings. This paper presents a comprehensive examination of methodological considerations and validity concerns in web surveys, aiming to optimize their effectiveness and enhance the quality of research outcomes. Methodological aspects such as survey design, question formulation, sampling techniques, and data collection procedures are explored, emphasizing the need for best practices and guidelines. A standardized close-ended questionnaire was distributed to researchers conducting web surveys to collect data. A random distribution was used to get a sample size of 200 questionnaires, of which 170 were successfully collected. However, by eliminating the incomplete data, 150 replies were received, indicating a response rate of 85%. In order to achieve this objective, this study employed Structural Equation Modelling (SEM) to analyze the data that was collected from participants who utilized web surveys in their research studies. The results revealed that methodological aspects of web surveys significantly enhance reliability and validity, reduce challenges and biases associated with web surveys, and optimize their effectiveness. Furthermore, the results confirmed that reliability and validity and challenges and biases associated with web surveys fully mediate the relationship between methodological aspects of web surveys and the optimization of their effectiveness. Researchers can deliberately improve participant engagement and enhance response rates and data quality by prioritizing methodological concerns and validity. Personalized survey invites, gamification or interactive aspects, smooth mobile compatibility, and well-structured incentives are essential to strengthen participant interest and commitment. Furthermore, the implementation of rigorous data quality protocols, including validation procedures and attention prompts, plays a crucial role in upholding the integrity of the gathered data. Researchers can strategically enhance participant engagement by focusing on methodological considerations and validity to bolster response rates and data quality. Implementing personalized survey invitations, integrating gamification or interactive elements, ensuring seamless mobile compatibility, and offering well-structured incentives collectively foster participant interest and commitment. Additionally, diligent data quality measures, such as validation checks and attention prompts, contribute to the integrity of collected information. By addressing these issues and advancing the understanding of web survey methodologies, researchers can optimize the validity and reliability of their findings, strengthening the overall quality of web survey research.

Keywords: web surveys, methodological considerations, validity, challenges and biases, and optimization.

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INTRODUCTION

Background and Rationale for the Research

In the era of digital advancements, Web surveys have become widely utilized and convenient for collecting data in research studies (Khan, 2023). Their ease of administration, cost-effectiveness, and ability to reach a wide and diverse audience make them attractive for researchers across various disciplines. However, optimizing Web surveys and considering methodological considerations are crucial to ensure the validity of research findings.

The rationale for this study stems from the growing utilization of Web surveys as a means of data collection and the imperative to improve their methodological approaches. Despite their advantages, Web surveys can be vulnerable to various methodological challenges, such as low response rates, non-response bias, self-selection bias, and potential issues related to data quality and representativeness. These challenges can undermine the validity and generalizability of research findings, compromising their utility in informing decision-making and policy development.

The rationale for this research is driven by the importance of optimizing Web surveys to maximize their methodological rigor and validity. By identifying and understanding the methodological considerations specific to Web surveys, researchers can develop strategies to address these challenges effectively. This study contributes to the existing literature by offering valuable insights into the optimal practices and methodological considerations that researchers should employ while utilizing Web surveys in their research endeavors. By addressing these considerations, researchers can minimize biases, improve response rates, enhance data quality, and ensure the validity and reliability of their findings.

Furthermore, this research is essential for both researchers and practitioners who rely on Web survey data for evidence-based decision-making. By optimizing the methodological practices in Web surveys, researchers can provide more accurate and reliable data that can inform policy development, program evaluation, and educational interventions. This research will also contribute to the broader field of research methodology by highlighting the unique challenges and considerations associated with Web surveys and proposing strategies to mitigate them.

In conclusion, the objective of this research is to address the research gap by examining the methodological considerations and validity of Web surveys in research. By optimizing Web surveys and considering methodological best practices, researchers can ensure the quality and credibility of their findings, making them more valuable for evidence-based decision-making across various domains. This research is significant in enhancing the methodological practices related to Web surveys and improving the overall quality of research conducted in the digital age.

Statement of the Problem and Research Gap

Web surveys have become increasingly popular as a data collection method in research. However, despite their widespread use, there are significant methodological considerations and potential limitations that need to be addressed to ensure the validity of research findings. The problem statement for this research is the lack of comprehensive understanding and guidelines on optimizing Web surveys in research, specifically regarding methodological considerations and validity.

The existing literature on Web surveys in research often focuses on their advantages and practical aspects, such as ease of administration and cost-effectiveness. While these factors are important, there is a research gap when it comes to exploring the methodological considerations necessary to optimize Web surveys. This

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gap hampers the ability of researchers to conduct rigorous and valid research using Web surveys and limits the extent to which findings can be confidently applied to inform decision-making and policy development.

The research gap lies in the limited knowledge and guidelines regarding methodological considerations specific to Web surveys. This includes challenges related to sample selection, response rates, data quality, and potential biases. Additionally, there is a need to explore strategies and best practices that can beemployed to address these methodological challenges and increase the validity and reliability of study findings obtained through Web surveys.

By addressing this research gap, researchers can provide valuable insights into optimizing Web surveys, ensuring methodological rigor, and improving the validity of research conducted in digital environments. Such knowledge will enable researchers to design and implement Web surveys effectively, obtain representative and high-quality data, and contribute to the advancement of evidence-based decision-making in various fields.

In conclusion, the research problem is the lack of comprehensive understanding and guidelines for optimizing Web surveys in research, specifically concerning methodological considerations and validity. Bridging this research gap is crucial to ensure the methodological rigor of Web surveys, enhance the validity of research findings, and promote their effective utilization in informing decision-making and policy development.

Research Questions

1. What are the key methodological considerations specific to Web surveys that researchers need to address to guarantee the validity of research findings?
2. What are the challenges and potential biases associated with Web surveys, such as self-selection bias and non-response bias, and how do they impact the validity of research findings?
3. What strategies and best practices can be employed to optimize Web surveys and overcome methodological challenges, such as low response rates and data quality concerns?
4. How effective are the identified strategies and best practices in improving the validity and reliability of research findings obtained through Web surveys?
5. What are the guidelines and recommendations that can be developed to assist researchers in optimizing the use of Web surveys and ensuring methodological considerations and validity in their research?
6. Validity, and challenges and biases associated with Web surveys in research mediates the relationship between methodological aspects and optimization of Web surveys in research.

These research questions will guide the investigation into the methodological considerations, challenges, and strategies associated with Web surveys in research. By addressing these questions, researchers can gain an enhanced comprehension of the key issues and develop practical recommendations to optimize the use of Web surveys and enhance the validity of research findings.

Research Objectives and Significance

Research objectives

1. To identify and examine the key methodological considerations associated with Web surveys in research.
2. To explore the challenges and potential biases that researchers encounter when using Web surveys and their impact on the validity of research findings.

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1. To investigate strategies and best practices that can be employed to optimize Web surveys and enhance their methodological rigor.
2. To assess the effectiveness of these policies in enlightening the validity and reliability of research findings obtained through Web surveys.
3. To develop guidelines and recommendations for researchers to optimize the use of Web surveys and ensure methodological considerations and validity in their research.

Significance of the research

This research on optimizing Web surveys in research holds several key significances:

Enhancing Methodological Rigor: By identifying and addressing the methodological considerations specific to Web surveys, this research will contribute to improving the overall methodological rigor of research conducted in digital environments. It will provide researchers with insights into best practices and strategies to overcome challenges and biases linked with Web surveys, resulting in more valid and reliable research findings.

Validity of Research Findings: Addressing the methodological considerations and optimizing Web surveys will directly affect the validity of research findings. By implementing appropriate measures and guidelines, researchers can ensure that their findings accurately represent the target population, minimizing biases and increasing the trustworthiness of the results.

Improved Decision-Making and Policy Development: The findings of this study will have practical implications for decision-makers and policymakers who rely on research evidence to inform their actions. Optimized Web surveys will provide more accurate and reliable data, leading to better-informed decisions, effective program planning, and evidence-based policy development in various fields.

Research Efficiency and Cost-Effectiveness: By understanding and implementing methodological considerations specific to Web surveys, researchers can improve the efficiency and cost-effectiveness of their research processes. This can lead to significant time and resource savings, making Web surveys a preferred method for data collection in research.

Advancement of Research Methodology: This research will contribute to the progress of research methodology by providing insights and guidelines specific to Web surveys. It will expand the existing knowledge base and serve as a reference point for researchers aiming to conduct high-quality research using Web surveys.

The research objectives aim to address the methodological considerations and validity issues associated with Web surveys in research. The significance of this research lies in improving the methodological rigor, enhancing the validity of research findings, and providing guidelines for optimizing Web surveys, leading to improved decision-making, efficient research practices, and advancements in research methodology.

LITERATURE REVIEW AND HYPOTHESIS DEVELOPMENT

Theoretical Background

Web surveys have become more popular as a data collection method in various research domains due to their accessibility, cost-effectiveness, and convenience. This overview provides a glimpse into the use of web surveys across different fields, showcasing their applications and benefits.

Web surveys have become a valuable tool for gathering data in educational research. For example, they used

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to evaluate student satisfaction with online learning platforms (Almusharraf & Khahro,2020), measure teachers' attitudes towards technology integration (Vekiri & Chronaki, 2008), and explore student engagement in distance education (Liu & Cavanaugh, 2011).In the field of education, web surveys have been employed to gather feedback from students, parents, and educators on curriculum effectiveness, teaching methodologies, and school improvement initiatives (Bubb & Jones, 2020).Online surveys have also been utilized to investigate student satisfaction, engagement, and learning outcomes in e-learning environments (Arkorful & Abaidoo, 2015).Web surveys have been widely utilized in educational research to gather data on student experiences, learning outcomes, and satisfaction. They offer an efficient means of collecting information from large samples of students, parents, and educators (Jacob, Mato, & Akintola, 2015). Web-based questionnaires have been used to assess student engagement, evaluate online learning environments (Wong et al., 2015), and measure the effectiveness of educational interventions (Grolnick et al., 2016). In healthcare research, web surveys have proven to be an efficient method for collecting patient-reported outcomes, assessing health behaviors, and evaluating interventions. For instance, web surveys have been used to study medication adherence, patient satisfaction with healthcare services, and mental health screening (Gloster et al., 2020).Web surveys offer a valuable means for collecting patient-reported outcomes, measuring treatment effectiveness, and assessing healthcare quality (Menon,& Muraleedharan,2020).Researchers have employed web surveys to explore patient experiences, perceptions of healthcare services, and patient satisfaction in various healthcare settings (Bjertnaes, Iversen, & Skrivarhaug, 2018).In the healthcare field, web surveys have become valuable tools for gathering patient feedback, assessing healthcare quality, and conducting health-related research. Web-based questionnaires have been employed to study patient satisfaction with healthcare services (Rattray, & Jones, 2007) collect patient-reported outcomes (Hirschfeld et al., 2019), and investigate health behaviors and perceptions (Arni, Dragone, Goette, & Ziebarth,2021). Web surveys also offer advantages in recruiting diverse patient populations for clinical trials and observational studies (Gottesman, & Hamilton, 2021). Web surveys have revolutionized data collection in social science research. They have been employed to investigate social attitudes, gather demographic information, and examine societal trends. Researchers have used web surveys to explore public opinion on political issues, measure social support networks, and examine patterns of online behavior. Web surveys have been extensively used in social sciences research to study attitudes, behaviors, and societal trends (Höhne, Cornesse, Schlosser, Couper, & Blom, 2020). They enable researchers to collect data on topics such as political opinions, social networks, and cultural beliefs (Hadi, Lasri, & Abderrahmani, 2020) Studies in psychology and sociology have utilized web surveys to investigate personality traits, social interactions, and mental health indicators (Donegan& Gillan, 2022). Web surveys have revolutionized data collection in the social sciences, enabling researchers to reach broader and more diverse populations. Web-based surveys have facilitated research on sensitive topics by providing respondents with a level of anonymity and privacy (Smith, 2017). Web surveys have become a standard tool in market research due to their cost-effectiveness and ability to reach a large audience. They are used to collect consumer opinions, preferences, and purchasing behavior data. Web surveys have been employed in market segmentation studies (Chen & Hitt, 2002), brand perception research (Bian & Moutinho, 2011), and customer satisfaction surveys (Hasson, Piorkowski, & McCulloh, 2019). Web surveys have revolutionized market research by providing an efficient means of collecting consumer feedback, preferences, and purchasing behaviors (Dillman, Smyth, & Christian, 2014).

Researchers leverage web surveys to conduct customer satisfaction surveys, brand perception studies, and product testing in order to inform marketing strategies (Al-Azzam, & Al-Mizeed, 2021). Web surveys have become integral to market research, offering a cost-effective and efficient means of collecting consumer data. Web-based surveys have been employed in market segmentation studies, product testing, and customer satisfaction assessments (Oliveri et al., 2021). Web surveys have also found applications in environmental research, particularly in assessing public attitudes towards environmental issues, evaluating conservation programs, and gathering data on environmental behaviors. Researchers have utilized web surveys to study environmental awareness (Hornsey, Harris, Bain, & Fielding, 2016), assess pro-environmental behaviors,

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and understand public perception of climate change (Bamberg, Hunecke, & Blöbaum, 2007). Web surveys have been used to gather data on environmental attitudes, behaviors, and perceptions. Web surveys have been widely adopted in psychological research, facilitating data collection on various constructs and phenomena. Web-based questionnaires have also contributed to the development and validation of psychometric scales and longitudinal studies (van Gelder et al., 2017).

Web surveys offer researchers the ability to reach diverse populations, collect data efficiently, and analyze results quickly. However, it is important to address methodological considerations, such as sample representativeness, survey design, and response biases, to ensure the validity of findings and generalize results to the target population.

Advantages and Disadvantages of Web Surveys Compared to Traditional Survey Methods

Web surveys have become increasingly popular as a viable alternative to conventional survey techniques, including in-person interviews, telephone surveys, and mail-based questionnaires. There are a number of advantages associated with them; nevertheless, they also possess certain limits. This discourse elucidates the benefits and constraints of web-based surveys in comparison to conventional survey methodologies.

Advantages of web surveys

Cost-effectiveness: Web surveys are generally more cost-effective compared to traditional methods. They eliminate the need for printing, postage, and manual data entry, resulting in reduced costs. Researchers can reach a large number of participants at a fraction of the cost associated with traditional methods (Dillman, Smyth, & Christian, 2014).

Accessibility and Convenience: Web surveys provide participants with the convenience of accessing and completing surveys at their own pace and from any location with an internet connection (Bethlehem, 2010). This accessibility increases participation rates and allows for a geographically diverse sample.

Speed and Efficiency: Web surveys offer quick data collection and analysis. Researchers can distribute surveys instantly and collect responses in real-time, eliminating the delays associated with traditional methods (Couper, 2017). Automated data entry and analysis tools further enhance the speed and efficiency of data processing.

Flexibility in Questioning: Web surveys offer a range of question formats, encompassing multiple-choice, open-ended, and Likert scale inquiries. They offer branching and skip logic features, enabling personalized survey paths based on participant responses (Albaum et al., 2014). This flexibility enhances data quality and participant engagement.

Anonymity and Privacy: Web surveys provide respondents with a certain level of anonymity and privacy, leading to increased response rates, particularly in sensitive or stigmatized research topics (Couper, 2017). Participants may experience a greater sense of ease while disclosing personal information and expressing their thoughts in comparison to traditional methods such as face-to-face interviews or telephone surveys.

Disadvantages of web surveys

Digital Divide and Nonresponse Bias: Web surveys rely on internet access, which may result in a digital divide, potentially excluding certain populations who have limited or no internet access (Biffignandi & Bethlehem, 2021). This can introduce nonresponse bias and limit the generalizability of findings to the broader population (Couper, 2017).

Self-selection Bias: Web surveys are prone to self-selection bias, as respondents actively choose to

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participate. This bias may result in a non-representative sample, particularly if certain demographics or characteristics are more likely to participate or decline participation (Kaplowitz, Hadlock, & Levine, 2004).

Lack of Control over Respondent Environment: Unlike face-to-face or telephone surveys, researchers have limited control over the respondent's environment during web surveys. Distractions, multitasking, or other external factors may influence response quality and attentiveness (Dillman et al., 2014).

Limited Question Complexity: Web surveys may be less suitable for complex or lengthy questionnaires that require detailed explanations or visual aids (Bethlehem, Cobben, & Schouten, 2011). Respondents may be less inclined to engage with lengthy surveys online and may experience cognitive fatigue, potentially impacting response quality (Tourangeau, Conrad, & Couper, 2013).

Privacy and Data Security Concerns: Web surveys raise concerns about privacy and data security. Participants may hesitate to provide sensitive information online, leading to underreporting or biased responses (Bethlehem, Cobben, & Schouten, 2011). Ensuring data confidentiality and protecting against data breaches are critical considerations in web survey research (Dillman et al., 2014).

Technical Issues: Web surveys require internet access and compatible devices, which can pose challenges for participants with limited technological resources or skills (Couper, 2017). Technical issues, such as browser compatibility or survey design problems, can affect the survey experience and data quality.

Lack of Clarification and Probing: Unlike face-to-face interviews, web surveys lack the opportunity for immediate clarification or probing of participant responses. Researchers cannot gauge non-verbal cues or ask follow-up questions, potentially limiting the depth of data collected (Bethlehem, 2010).

While web surveys offer numerous advantages, researchers must be aware of these limitations and consider them when designing studies and interpreting results. Mitigating these limitations through careful survey design, appropriate sampling strategies, and data analysis techniques can boost the validity of web survey research.

Highlight the potential benefits of optimizing Web survey methodologies

Increased Response Rates: By optimizing various aspects of Web survey design, such as reducing survey length, improving survey layout, and utilizing interactive features, researchers can enhance respondent engagement and increase response rates (Couper, 2017; Dillman, Smyth, & Christian, 2014).

Improved Data Quality: Implementing methodological considerations in Web surveys can lead to improved data quality. Utilizing proper sampling techniques, employing reliable and validated measurement instruments, and incorporating data validation checks can enhance the accuracy and reliability of collected data (Bethlehem, Cobben, & Schouten, 2011; Gosling, Vazire, Srivastava, & John, 2004).

Enhanced Representativeness: Through the implementation of sampling strategies and the consideration of nonresponse biases, researchers can strive to achieve a more representative sample in Web surveys. This involves addressing potential selection biases and ensuring that the sample aligns with the target population (Couper, 2017; Kaplowitz, Hadlock, & Levine, 2004).

Cost-effectiveness: Optimizing Web survey methodologies can result in cost savings compared to traditional survey methods. By reducing printing and postage costs, streamlining data collection and analysis processes, and utilizing automated features, researchers can maximize cost-effectiveness (Bosnjak, Galesic, & Tuten, 2007; Fricker, & Schonlau, 2002).

Timeliness of Data Collection: Through optimized Web survey methodologies, researchers can collect data

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more efficiently and expedite the research process. With instant data capture and automated data management, researchers can obtain timely results for decision-making or analysis purposes (Kaplowitz, Hadlock, & Levine, 2004; Couper, 2017).

Flexibility and Adaptability: Web surveys offer flexibility in terms of survey administration and adaptability to diverse research settings. Researchers can easily modify surveys, target different populations, and employ innovative techniques such as adaptive questioning or randomization, enhancing the flexibility and adaptability of the research process (Galesic & Bosnjak, 2009; Dillman, Smyth, & Christian, 2014).

Data Accessibility and Storage: Optimized Web survey methodologies facilitate efficient data storage, organization, and retrieval. With data stored electronically, researchers can easily access and analyze survey data, utilize data management tools, and maintain data security and confidentiality (Couper, 2011; Gosling et al., 2004).

By incorporating optimization strategies into Web survey methodologies, researchers can reap these potential benefits, resulting in improved data collection, analysis, and overall research outcomes.

Methodological Considerations (MC) of Web Surveys

Explore various methodological considerations in Web surveys, such as survey design, question formulation, sampling techniques, and data collection procedures. Methodological considerations play a crucial role in ensuring the reliability and validity of Web surveys. Here, we explore several key aspects of Web survey methodology, including survey design, question formulation, sampling techniques, and data collection procedures, supported by relevant literatures:

Survey design

Visual Design: The visual layout and design of a Web survey can impact respondent engagement and data quality. Attention to aesthetics, clear instructions, and intuitive navigation can enhance the user experience and improve response rates (Couper, 2011).

Survey Length: Longer surveys tend to result in decreased response rates and increased respondent burden. Therefore, optimizing survey length is important for maintaining participant engagement (Dillman, Smyth, & Christian, 2014).

Question Formatting: Proper formatting of questions, including clear instructions, response options, and logical flow, is essential for minimizing respondent confusion and ensuring data accuracy (Couper, 2011).

Mobile Optimization: With the increasing use of mobile devices, optimizing Web surveys for mobile responsiveness is essential. Ensuring surveys are mobile-friendly improves accessibility and accommodates respondents who prefer to participate on their smartphones or tablets (Yang et al., 2019).

Question formulation

Clear and Concise Language: Using clear and concise language in survey questions minimizes the risk of respondent confusion or misinterpretation. Well-crafted questions with specific response options improve data accuracy (Tourangeau, Conrad, & Couper, 2013).

Question Order: The order of survey questions can influence response patterns. Researchers should carefully consider the sequencing of questions, starting with broad or introductory questions and progressively moving towards more specific or sensitive topics (Dillman, Smyth, & Christian, 2014).

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Use of Validated Measures: Incorporating reliable and validated measurement instruments in web surveys ensures the accuracy and validity of collected data (Gosling et al., 2004).

Sampling techniques

Probability Sampling: Utilizing probability sampling techniques, such as random sampling, helps ensure that the sample represents the target population and allows for generalizability of findings (Bethlehem, Cobben, & Schouten, 2011).

Nonprobability Sampling: When probability sampling is challenging or not feasible, researchers may employ nonprobability sampling methods, such as convenience sampling or quota sampling. While nonprobability sampling has limitations, it can still provide valuable insights within specific contexts (Bethlehem, Cobben, & Schouten, 2011).

Data collection procedures

Data Validation: Implementing validation checks in Web surveys helps ensure data accuracy. This includes employing logic checks, range checks, and skip patterns to prevent inconsistent or invalid responses (Couper, 2011).

Timing and Frequency: Researchers should consider the timing and frequency of survey administration to optimize response rates and minimize respondent fatigue (Bethlehem, Cobben, & Schouten, 2011).

Data Security and Confidentiality: Protecting respondent privacy is crucial in Web surveys. Implementing secure data collection procedures, anonymizing data, and using secure transmission methods help maintain confidentiality and foster respondent trust (Gosling et al., 2004).

By considering these methodological considerations in Web surveys, researchers can enhance the quality and reliability of their data, leading to more robust findings and meaningful research outcomes.

Challenges and biases associated with web surveys (CB)

Web surveys can be subject to a number of issues and potential biases that could skew the results of the study. Here are some of the common challenges and biases associated with web surveys and their impact on validity.

Self-selection bias: It occurs when individuals voluntarily choose to participate in a survey, potentially leading to a non-representative sample. This bias arises because certain groups may be more likely to participate than others, introducing a bias in the collected data (Yeager et al., 2011). Self-selection bias can impact the validity of research findings by distorting the representation of the target population, limiting generalizability and increasing the risk of biased results.

Non-response bias: Non-response bias refers to the phenomenon wherein individuals who opt out of participating in a survey exhibit systematic differences from those who choose to participate, resulting in a sample that is biased. Non-response bias can arise due to various factors, such as lack of interest, survey fatigue, or privacy concerns (Groves & Peytcheva, 2008). Non-response bias can impact the validity of research findings by introducing a distortion in the collected data and potentially leading to inaccurate conclusions.

Coverage bias: Coverage bias refers to the underrepresentation or overrepresentation of certain segments of the target population due to limitations in web survey coverage. For example, individuals without internet access or with limited digital literacy may be excluded from web surveys, leading to a biased sample

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conform to societal standards or expectations, rather than accurately reflecting their own ideas or behaviors. In web surveys, respondents may feel more anonymous and be less influenced by social desirability bias compared to face-to-face interviews (Couper, 2011). However, social desirability bias can still exist in web surveys, particularly when sensitive or socially undesirable topics are involved, impacting the validity of research findings.

Technical challenges: Web surveys may encounter technical issues, such as compatibility problems across devices or browser-related issues, which can lead to data collection errors and affect the validity of the research findings (Dillman, Smyth, & Christian, 2014).

These challenges and biases highlight the importance of understanding and mitigating their impact on the validity of research findings in web surveys. Researchers can employ various strategies to address these issues, such as implementing probability sampling techniques, utilizing incentives to encourage participation, conducting non-response analyses, and adjusting for potential biases through weighting or statistical techniques (Callegaro, Manfreda, & Vehovar, 2015; Yeager et al., 2011). Additionally, transparency in reporting the limitations and potential biases associated with web surveys is crucial for interpreting and generalizing the research findings accurately (Groves & Peytcheva, 2008). Top of FormTop of Form

Validity and reliability in web surveys (VR)

Validity issues specific to web surveys can impact the reliability and accuracy of the collected data.

Potential biases

Self-selection Bias: Web surveys rely on voluntary participation, which can introduce self-selection bias as respondents may have unique characteristics or motivations (Bethlehem, Cobben, & Schouten, 2011). This bias can impact the generalizability of findings to the target population.

*Sample Composition Bias:*The attributes of persons who possess internet connectivity and exhibit a willingness to engage in online participation may exhibit dissimilarities when compared to the wider population, hence resulting in samples that are biased. The presence of bias has the potential to impact the external validity of the study (Couper, 2017).

Nonresponse bias

Nonresponse Bias: Low response rates in web surveys can lead to nonresponse bias, where respondents differ from non-respondents in meaningful ways (Dillman et al., 2014). This bias can affect the representativeness and generalizability of the findings.

Item Nonresponse Bias: Incomplete responses to specific survey items can introduce bias if the missing data are related to the construct being measured (Couper, 2017). This bias can impact the internal validity of the study.

Self-selection bias

Volunteer Bias: Individuals who choose to participate in web surveys may differ systematically from non-participants, leading to volunteer bias (Bethlehem, Cobben, & Schouten, 2011). This bias can affect the generalizability of findings to the target population.

Digital Divide Bias: Limited internet access and technological proficiency among certain segments of the population can introduce bias in web surveys (Dillman et al., 2014). This bias can affect the

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representativeness of the sample and generalizability of results.

Data quality concerns

Response Quality: Web surveys are prone to response quality concerns such as speeding, careless responding, or satisficing, where respondents provide low-effort or inaccurate responses (Couper, 2017). This can impact the reliability of the collected data.

Measurement Errors: Errors can occur during the administration of web surveys, including response errors, interpretation errors, or errors related to skip patterns, leading to measurement errors (Dillman et al., 2014). These errors can compromise the validity of the measured constructs.

Addressing these validity issues requires careful consideration of sampling techniques, survey design, and data collection procedures. Researchers should be aware of these biases and employ appropriate strategies to minimize their impact on the validity of web survey findings.

Strategies and best practices for optimizing web surveys (SBP)

There are several strategies and best practices that can be employed to optimize web surveys and overcome methodological challenges, such as low response rates and data quality concerns.

Personalized Invitations: Sending personalized invitations that explain the purpose and importance of the survey can improve response rates. Personalization creates a sense of relevance and increases the likelihood of participation (Dillman, Smyth, & Christian, 2014).

Clear and Concise Survey Design: Using clear and concise language in survey questions, avoiding jargon or technical terms, and ensuring that questions are easy to understand can enhance response rates and data quality (Fowler Jr, 2013).

Incentives and Rewards: Providing incentives or rewards, such as gift cards or discounts, can motivate participants to complete the survey and increase response rates. However, it is important to ensure that incentives do not introduce bias into the data (Sax, Gilmartin, & Bryant, 2003).

Mobile-Optimized Surveys: Designing surveys that are compatible with mobile devices is essential, as an increasing number of participants access surveys through mobile devices. Mobile optimization improves accessibility and convenience, leading to higher response rates (Gummer, Höhne, Rettig, Roßmann, & Kummerow, 2023).

Multiple Contact Attempts: Implement multiple contact attempts to reach potential respondents, including reminders and follow-ups, to increase response rates (Couper, Kapteyn, Schonlau, & Winter, 2007).

Reminder Emails: Sending reminder emails to non-respondents can significantly improve response rates. These emails serve as gentle prompts and can increase the likelihood of participation. (Dillman et al., 2014)

Attention to Survey Length: Keeping the survey length reasonable and manageable is crucial. Long surveys can lead to respondent fatigue and reduced data quality. Shorter surveys are more likely to maintain participant engagement (Couper, 2017).

Quality Control Measures: Implementing quality control measures, such as regular monitoring of data collection, checking for data anomalies, and conducting data validation checks, ensures data quality and reduces the risk of errors (Couper, Tourangeau, Conrad, & Zhang, 2013).

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Pretesting and Pilot Testing: Conducting pretests and pilot tests with a small sample of participants helps identify potential issues, such as ambiguous questions or technical glitches, before launching the main survey. This process improves the reliability of the data collected. (Fowler Jr., 2013)

Transparent Data Handling: Clearly communicating how the collected data will be handled, including privacy protection and data anonymization measures, builds trust with participants and encourages honest responses. Transparency enhances data quality and validity. (Sax et al., 2003)

Timely Communication of Results: Sharing the results of the survey with participants who have expressed an interest in the findings can foster participant engagement and promote future participation. Timely communication demonstrates transparency and respect for participants' contribution (Dillman et al., 2014).

It is crucial to acknowledge that the efficacy of these strategies may differ based on the particular research context and target population. It is imperative for researchers to thoroughly evaluate the suitability and practicality of each strategy within the context of their own studies.

Guidelines and recommendations (GR) for optimizing web surveys

Based on generally accepted practices described in the literature, these general recommendations and guidelines. These guidelines and recommendations aim to assist researchers in optimizing the use of web surveys and ensuring methodological considerations and validity in their research.

Clearly define research objectives and target population: Clearly articulating research objectives and identifying the specific target population helps in designing appropriate web surveys and ensuring the validity and relevance of the collected data (Dillman, Smyth, & Christian, 2014).

Pay attention to survey design: Follow established survey design principles, such as using clear and concise language, structuring questions logically, and avoiding leading or biased questions. Well-designed surveys contribute to the validity and reliability of the research findings (Couper, 2008).

Use validated and reliable measurement scales: When selecting measurement scales or developing new ones, researchers should prioritize validated and reliable instruments to ensure the validity and accuracy of the collected data (Couper, 2008).

Employ appropriate sampling techniques: Choose appropriate sampling techniques that align with the research objectives and target population. Probability sampling methods, such as random sampling, enhance the generalizability and validity of the research findings (Dillman et al., 2014).

Consider sample size and power analysis: Conducting a power analysis helps determine the appropriate sample size for achieving adequate statistical power. Adequate sample sizes contribute to the reliability and generalizability of the research findings (Faul, Erdfelder, Lang, & Buchner, 2007).

Ensure participant privacy and data confidentiality: Clearly communicate the measures taken to ensure participant privacy and data confidentiality. Assuring participants of anonymity and data protection enhances response rates and the validity of the research findings (Callegaro, Manfreda, & Vehovar, 2015).

Implement data quality checks: Establish quality control procedures to identify and address data quality issues, such as outliers, missing data, or inconsistent responses. Data cleaning and quality checks contribute to the reliability and validity of the research findings (Couper, 2008).

Pilot test the web survey: Perform a preliminary examination of the online survey by administering it to a

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limited number of individuals in order to detect any possible concerns pertaining to the comprehensibility of the questions, the available response choices, or the technical performance. Pilot testing helps refine the survey instrument and improve the overall data quality (Dillman, Smyth, & Christian, 2014).

Provide clear instructions and guidance: Clearly communicate instructions to participants, including guidance on how to complete the survey, how to navigate through the survey interface, and how to respond to different question types. Clear instructions minimize response errors and enhance the validity of the research findings (Callegaro, Manfreda, & Vehovar, 2015).

Transparently report survey methodology: Provide a detailed description of the web survey methodology in research publications, including information about sampling procedures, survey design, data collection timeline, and any limitations or potential biases. Transparent reporting promotes research reproducibility and supports the validity of the research findings (Couper, 2008).

These guidelines and recommendations serve as a starting point for researchers, and it is important to adapt them based on the specific research context, objectives, and target population. Consulting relevant literature in the field will provide more specific and detailed guidance.

Identification of Gaps in the Literature

The research gap in the area of optimizing web surveys in research is the need for more studies that specifically address the methodological considerations and validity concerns associated with web surveys. While there is existing literature on web surveys, there is still a lack of comprehensive research that focuses specifically on the methodological aspects and validity concerns in the context of web surveys. This research gap is important because web surveys have become increasingly popular in research due to their convenience and cost-effectiveness. However, there are unique methodological challenges and validity issues that need to be addressed to ensure the validity of research findings obtained through web surveys. Further research is needed to delve deeper into the specific methodological considerations, such as survey design, question formulation, sampling techniques, and data collection procedures, that are essential for optimizing web surveys. Additionally, the impact of potential biases, such as self-selection bias and non-response bias, on the validity of research findings obtained through web surveys should be further investigated. Addressing this research gap will contribute to enhancing the methodological rigor and validity of web survey research, providing researchers with valuable insights and guidelines for conducting high-quality studies in various fields of research.

Hypothesis Development

The following hypotheses are made in this investigation in light of the aforementioned factors:

H1: *The methodological considerations specific to web surveys significantly influence the validity of research findings.*

H2: *The methodological considerations specific to web surveys significantly influence the challenges and biases of web surveys.*

H3: *The methodological considerations specific to web surveys significantly influence the optimizing the web surveys.*

H4: *Challenges and biases associated with web surveys, such as self-selection bias and non-response bias, have impact the validity of research findings.*

H5: *Challenges and biases linked with web surveys have impact to optimize web surveys.*

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H6: *The implementation of strategies and best practices in web surveys leads to optimize web surveys.*

H7: *The development of guidelines and recommendations for researchers in web surveys in research significantly influences to optimize the web surveys.*

H8: *The optimization of web surveys is impacted by the validity and reliability of research findings obtained through such surveys.*

H9: *Validity and reliability mediate the relationship between methodological aspects and optimized web surveys.*

H10: *Validity and reliability mediate the relationship between challenges and biases associated with web surveys and optimization of web surveys.*

H11: *Challenges and biases mediate the relationship methodological aspects and optimized web surveys in research.*

The proposed model, as depicted in Figure 1, is based on the preceding discussion regarding the formulation of hypotheses.

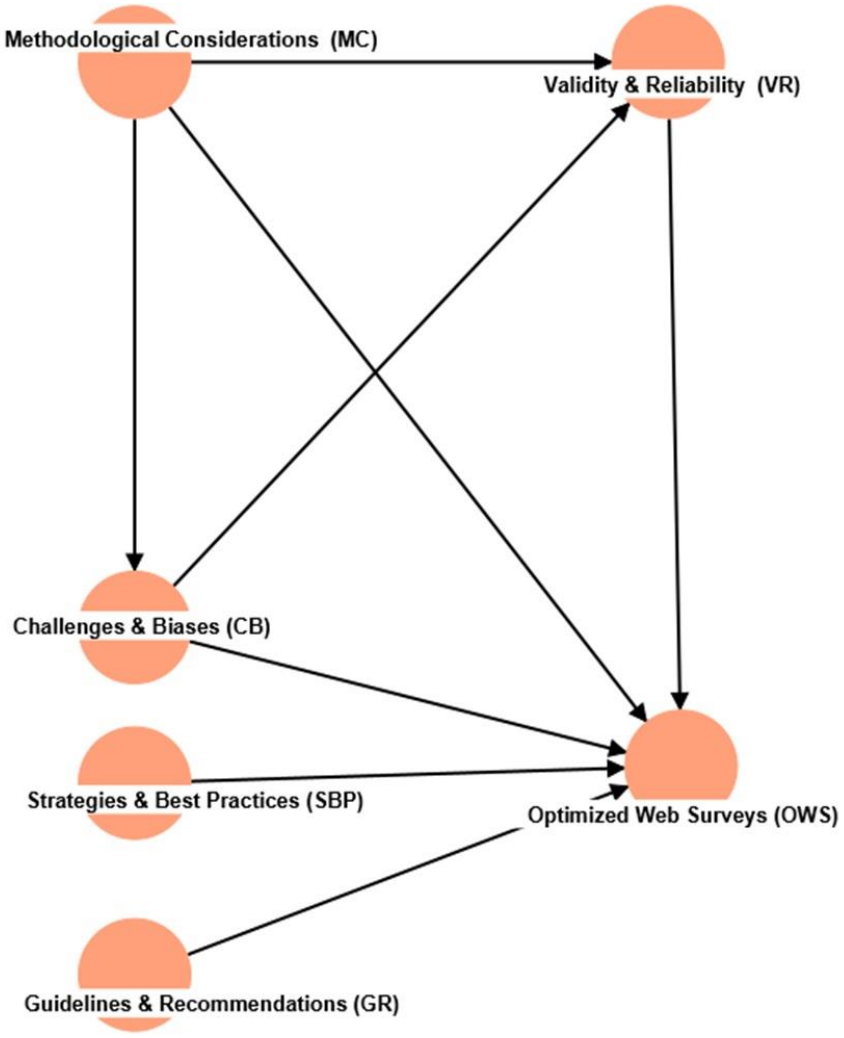

Figure 1. Proposed Model

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RESEARCH METHODOLOGY

Sample and Data Collection Procedure

In order to gather data, a standardized close-ended questionnaire was disseminated to researchers that do research through web surveys. The researchers doing this study on optimizing web surveys in research have been chosen based on the dearth of previous studies exploring methodological concerns and validity in this specific setting. Web surveys have become increasingly prevalent and convenient as a means of gathering data in research endeavors. The attractiveness of surveys for researchers from other fields stems from their ease of administration, cost-effectiveness, and capacity to reach a broad and diverse range of participants. This research attempt aims to address the existing knowledge gap by providing insights into the correlation between tactics, practices, and recommendations, and the optimization of web surveys in the field of research. The objective of this study is to ascertain the most effective strategies for enhancing the efficiency of web surveys, as well as ensuring the validity and reliability of the collected data. The outcomes of this research will serve as a foundation for future investigations and the development of policies in this domain. A sample size of 200 questionnaires was randomly distributed, and 170 of them were successfully collected. Nevertheless, when excluding the partial data, a sum of 150 fully completed responses was obtained, resulting in a response rate of 85%. These retained responses will be subjected to subsequent analysis. Previous research has indicated that in order to achieve a comprehensive and accurate analysis, it is generally recommended to have a minimum of three indicators per factor in an investigation. Furthermore, a sample size of 150 is typically deemed adequate for obtaining a convergent and appropriate solution (Anderson & Gerbing, 1984). Consequently, the demographic information of the participants may be observed in Table 1.

Table 1. Respondents' Demographic Profile.

Items	Categories	Frequency	Percent
Professional Background	Academic/Researcher	80	53.33
	Industry Professional	30	20.00
	Government/Non-profit	25	16.67
	Student	15	10.00
Web survey platform	Qualtrics	20	13.33
	SurveyMonkey	60	40.00
	Google Forms	30	20.00
	Lime Survey	20	13.33
	Other	20	13.33
Total		150	100

Measurement Instrument

The participants were requested to fill out a structured questionnaire with closed-ended questions in order to evaluate the optimization of web surveys in research. The survey utilized a Likert scale consisting of five points, ranging from one (indicating strong disagreement) to five (indicating strong agreement). The questionnaire items were derived from previous scholarly investigations on web surveys in research (Khan, 2023; Khan, 2018a; Khan, 2018b; Couper, 2017; Dillman, Smyth, & Christian, 2014; Bethlehem, Cobben, & Schouten, 2011; Couper, 2011; Bethlehem, 2010, Couper, 2008). The survey comprised of two distinct

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components: demographic and item-related portions. The study encompassed a total of forty-two (42) items, which were categorized into six (6) latent variables. The objects corresponding to each construct have been provided in Appendix A.

Variables Description

The study defines each of the latent variables, for optimizing web surveys based on the prior studies presented in Table 2

Table 2. Variables Description

Variables	**Descriptions**
Methodological Considerations (MC)	Researchers must carefully examine survey design components such visual design, survey duration, question structure and layout, and mobile optimization and proper sampling technique to ensure study findings' validity and reliability(Dillman, Smyth, & Christian, 2014; Couper, 2000; Bethlehem, 2010;Couper 2008).
Challenges and Biases (CB)	Web surveys are vulnerable to several biases, including self-selection bias, non-response bias, coverage bias, social desirability bias, and technical challenges, all of which can undermine the validity of research findings. Researchers must exercise caution when interpreting and generalizing results from web surveys to ensure the reliability and accuracy of their conclusions(Couper, 2008; Dillman, Smyth, & Christian, 2014).
Validity and Reliability (VR)	The web survey methodology in this study incorporated measures to enhance the reliability and validity of research findings, including high internal consistency, minimized response bias in questionnaire design, appropriate sampling, robust statistical analysis, alignment with established theories, transparent research procedures, acknowledgement of limitations, and validation of measures, all contributing to the credibility of the research findings within the field(Couper,2008; Dillman, Smyth, & Christian, 2014).
Strategies and Best Practices (SBP)	Implementing various strategies such as reminder emails, clear language in survey questions, skip patterns, and data validation checks can enhance participant engagement and data quality in web surveys. Following best practices for data quality assurance, adopting efficient techniques to optimize response rates, and conducting pilot testing can significantly improve the validity and reliability of research findings obtained through web surveys (Dillman, Smyth, & Christian, 2014; Fowler Jr., 2013; Callegaro, Manfreda, & Vehovar, 2015; Couper,2008).
Optimized Web Surveys (OWS)	Implementing strategies to increase response rates in web surveys has a positive impact on the validity of research findings. Following best practices for data quality assurance significantly enhances the reliability of research findings obtained through web surveys, making the identified strategies effective in improving the validity and reliability of the research(Couper, 2008; Bethlehem, 2010).
Guidelines and Recommendations (GR)	Developing comprehensive guidelines for web surveys, encompassing survey design, question formulation, sampling, and data collection procedures, will aid researchers in addressing methodological considerations specific to web-based research. These guidelines will emphasize improving response rates, data quality, and research validity, ultimately optimizing web surveys and enhancing the overall quality and reliability of research findings in this domain (Tourangeau, Conrad, & Couper, 2013; Couper, 2008; Dillman, Smyth, & Christian, 2014).

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Data Analysis Tools

The research employed Partial Least Squares–Structural Equation Modelling (PLS-SEM) as the analytical technique to investigate the proposed association. Given its ability to estimate complex structural relationships between variables and examine mediating effects, the use of PLS-SEM is particularly appropriate for this model. In addition, it has been found that Partial Least Squares Structural Equation Modelling (PLS-SEM) has the ability to yield dependable outcomes even when working with a limited sample size (Van Riel, Henseler, Kemény, & Sasovova, 2017). The PLS-SEM analysis was conducted with the Smart PLS 4 software, with the model being constructed based on a causal approach as outlined by Hair et al. (2021). In order to elucidate the intricate relationships between several predictor variables and multiple dependent variables, this research employed various statistical methodologies, such as measurement and structural models. The primary objective of the structural model was to examine the interplay of latent variables, while the measurement model aimed to analyze the associations between observable factors and latent variables. The descriptive statistics in this study involved the estimation of the mean, standard deviation, skewness, and kurtosis. In addition, the study conducted an analysis to assess the consistency and reliability of the data by calculating Cronbach's Alpha (CA) coefficient, Average Variance Extracted (AVE), and Composite Reliability (CR). Additionally, the study employed the estimation of R2 to assess the model's explanatory capability and performed the Fornell-Larcker test to evaluate the discriminant validity of the constructs. In addition, the study conducted an analysis of HTMT correlations to assess the internal correlations between the variables and identify any potential issues of multicollinearity. Finally, a structural equation modelling (SEM) approach was employed to evaluate the significance of the hypothesized associations.

RESULTS

Descriptive Statistics

In order to conduct a descriptive analysis, the study computed various statistical measures including the mean, standard deviation, kurtosis, and skewness. These results are presented in Table 3. The study found that the average score for all questions was within the range of 4-5, suggesting that the majority of respondents expressed a moderate level of agreement with the items related to optimized web surveys and their indicators. Furthermore, the standard deviations exhibited a range of 0.5 to 0.9, indicating a homogeneous dispersion of the items. In addition, it is worth noting that the kurtosis and skewness values were found to be below the thresholds of 3 and 10, respectively, as stated by Ringle, Wende, and Becker (2015). This observation provides evidence supporting the normality of the data and its appropriateness for subsequent study. Furthermore, it should be noted that all items in the study exhibited Variance Inflation Factor (VIF) values that were below the established threshold of 10, as indicated by Ringle, Wende, and Becker (2015). This suggests that multicollinearity was not present in the study. Ultimately, due to the utilization of a singular methodology for gathering both predictor and outcome data, the study sought to investigate the potential occurrence of Common Method Bias (CBM) and subsequently verified the absence of CBM.

Table 3. Descriptive Statistics with VIF

Variables	Items	Mean	Standard deviation	Kurtosis	Skewness	VIF
Methodological Considerations (MC)	MC1	4.305	0.818	-1.239	-0.622	1.133
	MC2	4.933	0.539	0.451	-0.053	1.218
	MC3	4.571	0.674	0.392	-1.305	1.242

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Challenges and Biases (CB)	CB4	4.143	0.576	-0.112	-0.012	1.188
	CB5	4.314	0.843	-1.292	-0.655	1.091
	CB6	4.476	0.732	-0.387	-1.027	1.331
	CB7	4.214	0.664	-0.719	0.098	1.113
	CB8	4.314	0.634	0.722	-0.382	1.048
	CB9	4.476	0.571	-0.687	-0.529	1.097
Validity and Reliability (VR)	VR10	4.581	0.593	-1.926	-0.333	1.147
	VR11	4.801	0.559	-0.162	-0.027	1.208
	VR12	4.048	0.608	-0.260	-0.024	1.089
	VR13	4.238	0.737	-1.071	-0.414	1.116
	VR14	4.886	0.694	-0.916	0.159	1.067
	VR15	4.981	0.537	1.922	-0.139	1.175
	VR16	4.695	0.794	-1.165	0.608	1.040
	VR17	4.190	0.885	-1.636	-0.386	1.167
	VR18	4.971	0.639	-0.524	0.025	1.477
	VR19	4.314	0.761	-1.035	-0.604	1.771
Strategies and Best Practices (SBP)	SBP20	4.219	0.534	-0.119	0.14	1.422
	SBP21	4.305	0.692	-0.832	-0.494	1.246
	SBP22	4.067	0.772	-1.319	-0.116	1.236
	SBP23	4.495	0.782	-0.406	-1.135	1.256
	SBP24	4.381	0.832	-1.069	-0.82	1.383
	SBP25	4.010	0.588	1.318	0.024	1.409
	SBP26	4.190	0.581	0.384	0.476	1.248
	SBP27	4.248	0.614	-0.555	-0.208	1.849
	SBP28	4.010	0.561	0.2500	0.003	2.266
	SBP29	4.533	0.705	-0.389	0.957	2.187
	SBP30	4.200	0.989	-0.134	-1.013	1.519
	SBP31	4.267	0.442	-0.871	1.071	1.919
	SBP32	4.067	0.503	0.956	0.126	1.665
	SBP33	4.124	0.511	0.606	0.191	2.004
	SBP34	4.152	0.548	0.098	0.07	1.253
Optimized Web Surveys (OWS)	OWS35	4.143	0.401	1.806	1.122	1.965
	OWS36	4.095	0.508	0.780	0.161	1.891
	OWS37	4.124	0.511	0.606	0.191	1.858
	OWS38	4.162	0.806	-1.410	-0.306	1.570
Guidelines and Recommendations (GR)	GR39	4.238	0.787	-1.257	-0.453	1.490
	GR40	4.152	0.714	-1.019	-0.235	1.897
	GR41	4.533	0.663	0.057	-1.119	1.284
	GR42	4.362	0.917	-1.366	-0.787	1.284

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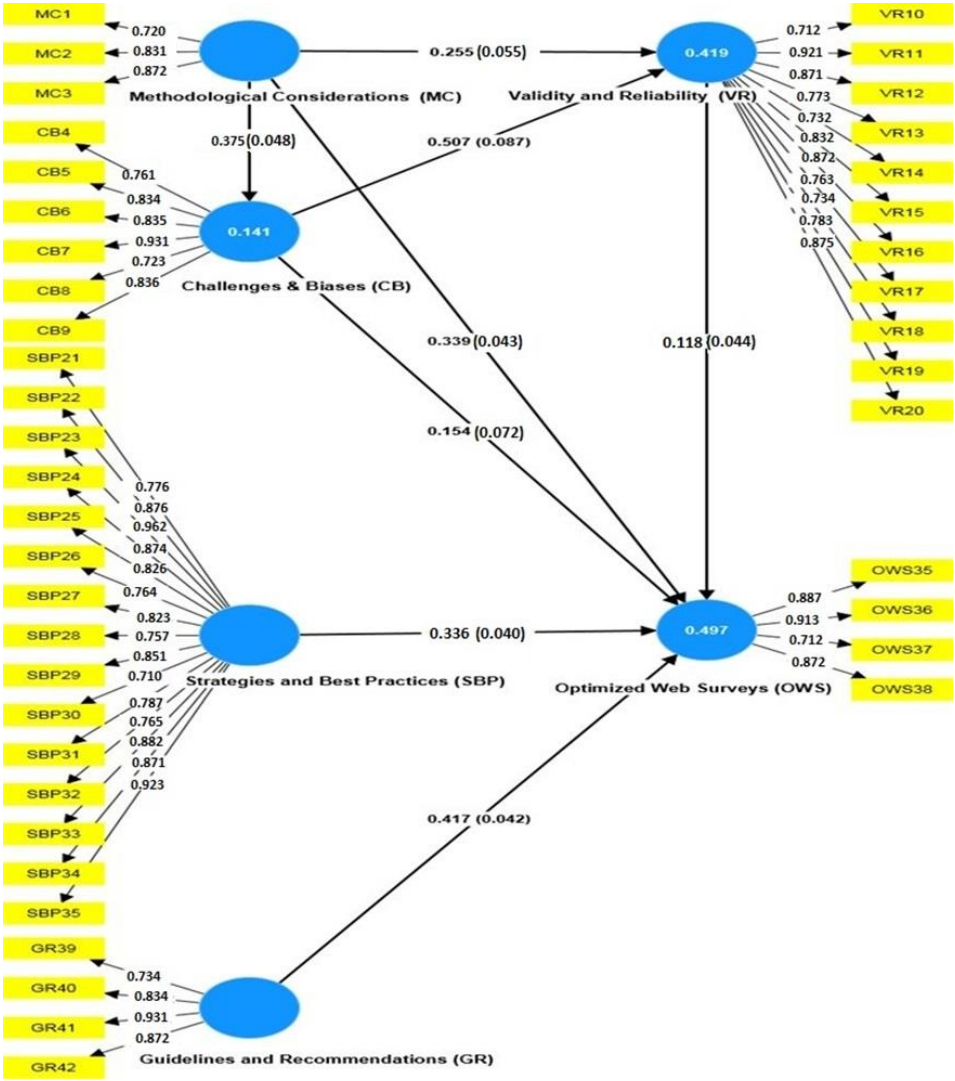

Figure 2. Measurement Model

Table 4. Reliability

Variables	Cronbach's alpha	Composite reliability (rho_a)	Composite reliability (rho_c)	Average variance extracted (AVE)	
Methodological Considerations (MC)	0.913	0.820	0.813	0.741	—
Challenges and Biases (CB)	0.726	0.752	0.8228	0.725	0.274
Validity and Reliability (VR)	0.731	0.788	0.703	0.824	0.428
Strategies and Best Practices (SBP)	0.713	0.792	0.711	0.818	—
Optimized Web Surveys (OWS)	0.834	0.750	0.818	0.729	0.405
Guidelines and Recommendations (GR)	0.817	0.735	0.759	0.730	—

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Further, this study investigates the convergent validity by employing the Average Variance Extracted (AVE) measure. The AVE values ranged from 0.725 to 0.824, surpassing the established threshold of 0.05 (Hair, Hollingsworth, Randolph, & Chong, 2017). Hence, the study meets the requirements for convergent validity. Furthermore, the researchers utilized the Heterotrait-Monotrait correlation ratio (HTMT) criterion to assess the discriminant validity of the research constructs. The results about discriminant reality, as presented in Table 5, indicate that all component HTMT values were below 0.90. This finding proves there is no issue with discriminant fact (Hair, Black, Babin, Anderson, 2010).

Table 5. Discriminant Validity

Variables	CB	GR	MC	OWS	SBP	VR
Challenges & Biases (CB)						
Guidelines and Recommendations (GR)	0.831					
Methodological Considerations (MC)	0.831	0.631				
Optimized Web Surveys (OWS)	0.845	0.743	0.419			
Strategies and Best Practices (SBP)	0.801	0.801	0.795	0.809		
Validity and Reliability (VR)	0.894	0.704	0.815	0.822	0.764	

Model Fit Statistics

Table 4 illustrates the predictive efficacy of the constructs, so demonstrating the extent to which the explanatory variables of the model accurately forecast outcomes. The findings demonstrated that difficulties and biases, validity and reliability, and optimized web surveys had respective predictive powers of 0.274, 0.428, and 0.405. According to previous scholarly works, a coefficient of determination exceeding 0.26, as suggested by Cohen (1988), is considered to demonstrate a substantial level of predictive capability. The researchers conducted Confirmatory Factor Analysis (CFA) on the final measurement model in order to assess the level of fit of the measuring model. The soundness of the CFA model relies on the degree to which the conceptual model is well-aligned. In order to assess the adequacy of the model, the study utilized the Standardized Root Mean Square Residual (SRMR), which serves as a metric for quantifying the disparity between the observed correlation and the correlation matrix predicted by the model. The findings indicated that the SRMR value was 0.05, which falls below the established threshold of 0.08 (Steiger, 2007), hence validating the adequacy of our suggested model.

SEM Hypotheses Testing

In order to examine the provided hypotheses, the study employed the structural equation modelling (SEM) method, which is a widely used multivariate statistical technique for assessing the validity of the association between latent variables (Hair, Black, Babin, Anderson, 2010). Moreover, the structural equation modelling (SEM) approach is deemed appropriate for both intricate and straightforward models (Hair et al., 2021). This method yields outcomes that encompass the pathways, beta coefficients, t-statistics, and p-values. The results of the structural equation modelling (SEM) analysis are displayed in Table 6. These findings indicate that the methodological factors unique to web surveys have a substantial impact on the accuracy and consistency of research outcomes (**β1** = 0.255, p = 0.055), hence providing support for Hypothesis 1. The coefficient value suggests that a 1% increase in MC is associated with a 0.392% increase in VR. In a similar vein, the study found that MC had a significant effect on CB (**β1** = 0.375, p = 0.048), so providing support for Hypothesis 2. The findings also indicate that a 1% variation in MC corresponds to a 0.375% variation in CB. The main conclusion (MC) of the study was that there is evidence to suggest that the variable of interest **(**OWS) is positively influenced by a factor (**β1**) with a coefficient of 0.339 and a p-value of 0.043. This

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finding is statistically significant at the 5% level, providing support for hypothesis H3. The findings of the study revealed that an increase of 1% in MC would lead to a corresponding improvement of 0.339% in OWS. Furthermore, it can be observed from Table 6 that the variable CB has a positive and statistically significant effect on both VR (β1 = 0.507, p = 0.087) and OWS (β1 = 0.154, p = 0.072), hence providing support for H4 and H5, respectively. The findings additionally demonstrated that a 1% rise in the CB led to a corresponding increase of 0.507% in the VR and 0.154% in the OWS. In a similar vein, the findings also demonstrate that BSP, GR, and VR exhibit a statistically significant positive influence on OWS at a significance level of 5%. Consequently, these results provide support for hypotheses H6, H7, and H8, respectively.

Table 6. Results of hypotheses

Hypothesis	**Paths**	**Beta value**	**t-statistics**	**p value**	**Remarks**
H1	MC→VR	0.255	1.925	0.055	Supported
H2	MC→CB	0.375	2.003	0.048	Supported
H3	MC→OWS	0.339	2.118	0.043	Supported
H4	CB→VR	0.507	1.709	0.087	Supported
H5	CB→OWS	0.154	1.809	0.072	Supported
H6	SBP→OWS	0.336	2.016	0.040	Supported
H7	GR→OWS	0.417	2.029	0.042	Supported
H8	VR→OWS	0.118	2.285	0.044	Supported

Indirect effects

Hypothesis	Paths	Beta value	t-statistics	p value	Remarks
H9	MC→ VR→OWS	0.030	2.123	0.040	Supported
H10	CB→VR→OWS	0.060	2.023	0.049	Supported
H11	MC→CB→OWS	0.058	1.997	0.048	Supported

More precisely, VR significantly enhances the beneficial effects of MC and CB on OWS. At the 5% significance level, the SEM hypothesis results also revealed that CB mediates the link between MC and OWS. Consequently, the findings corroborated H9, H10, and H11 and further demonstrated that a 1% increase in MC, CB, and MC would improve the OWS by 0.030%, 0.060%, and 0.058% via VR and CB, respectively.

DISCUSSION AND CONCLUSIONS

The study examines whether methodology of web surveys impacts optimizing web surveys in research through the mediating effect of reliability and validity, and challenges and biases. The results revealed that the proper employed of methodology of web surveys increases reliability and validity as well as optimizes it in research. Moreover, challenges and biases and reliability and validity fully mediate the relationship between methodological considerations and optimization of web surveys, indicating that if researchers enhance reliability and validity and minimize the challenges and biases of web surveys in research its methodological considerations, strategy and best practices, and guidelines and recommendations will optimize web surveys. The presence of a positive correlation between MC, VR, CB, and OWS is evident in Table 6 and Figure 2. The empirical findings provide support for hypotheses H1, H2, and H3, and are in line with the results reported in other studies (Dillman, Smyth, & Christian, 2014; Bethlehem, 2010; Couper,

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2008; Couper, 2011; Couper, 2017). The findings implies that the appropriate utilization of web surveys' methodology, the larger their reliability and validity. In other words, if proper sampling techniques, data collection procedures, such as clear instructions, secure data transmission, data validation, timing and frequency, and privacy protection and researchers need to carefully consider the survey design elements, such as visual design, survey length, question format and layout and mobile optimization, to decreases the biases and increase the validity and reliability of the research. Moreover, increased of reliability and validity optimizes the web surveys in research. Thus, the study evidenced that the proper methodology is used in web surveys plays a crucial role to optimize web surveys.

Furthermore, it is worth noting that there exists a notable and positive correlation between CB, VR, and OWS, which provides support for hypotheses H4, H5, and H8. The findings are consistent with the research conducted by Bethlehem (2010) and Couper (2011).The result indicates that if biases (selection bias, non-response bias, coverage bias, social desirability bias) and technical challenges can be reduced, reliability and validity will be enhanced (Dillman, Smyth, & Christian, 2014). Moreover, enhancement of reliability and validity optimizes the web surveys in research. Therefore, the study documented that challenges and biases associated with web surveys (CB) and validity and reliability in web surveys (VR) plays a significant role for optimization of web surveys.

The study also discovered a substantial positive correlation between strategies and best practices for optimizing web surveys (SBP), Guidelines and recommendations (GR) and Optimized Web Surveys (OWS), thereby supporting H6 and H7 as well as the findings of prior studies (Fowler Jr., 2013 and Couper, 2008).

Strategies and best practices like as implementing reminder emails or follow-up communications, using clear and concise language, employing skip patterns or branching logic, employing multiple contact attempts to reach potential respondents, offering incentives, or using personalized invitations, data validation checks, skip patterns, and response consistency checks, use pre-testing to identify and address any issues with the survey instrument before deployment, assure participants that their responses will be kept anonymous and confidential, triangulation of data from different sources, conduct pilot testing of the web survey, cognitive interviewing, content analysis, offer clear and concise instructions to respondents optimize web surveys. In addition, comprehensive web surveys guidelines and recommendations optimize web surveys in research (Tourangeau, Conrad, & Couper, 2013). The findings suggest that strategies and best practices and comprehensive guidelines and recommendations enhance the web surveys in research.

Further, the results revealed that reliability and validity and challenges and biases associated with web surveys fully mediate the relationship between data collection methodology and optimized web surveys, thus supporting H9, H10 and H11. The research revealed that the careful evaluation of methodological aspects in web surveys has a direct and indirect impact on the reliability and validity of the data collected, as well as the obstacles and biases that may arise. These factors, in turn, contribute to the optimization of web surveys. The outcomes illustrate that when proper web surveys methodology utilized, its reliability and validity will increase as well as challenges and biases associated with web surveys will reduce. CB is therefore viewed as a crucial element in optimizing web surveys (Dillman, Smyth, & Christian, 2014; Bethlehem, 2010, Couper, 2011) because it also mediates the impact of methodological consideration performance on VR.

Theoretical and Practical Implications of the Study

This paper contributes value to the existing literature regarding theoretical advancements and practical implications. To begin with, this study presents a conceptual model that explores the link between web

survey methodology and how to optimize web surveys encompassing the mediating effect of "reliability and validity" and "challenges and biases" associated with web surveys. Particularly, the study fills the research gap on the relationship between web surveys methodology and optimization of web surveys in current research. In addition, the study confirmed that web surveys methodological aspects significantly impact to optimize web surveys and "reliability and validity" and challenges and biases associated with web surveys play a fully mediating role between them. In conclusion, this study provides valuable insights for researchers who are required to utilize web surveys in research.

This study offers significant insights into the measures required to enhance the effectiveness of web surveys by considering methodological factors. The practical implications inherent in optimizing web surveys for research encompass a realm of strategies aimed at ensuring the effectiveness and reliability of data collection. By focusing on methodological considerations and validity, researchers can strategically enhance participant engagement to bolster response rates and data quality. Implementing personalized survey invitations, integrating gamification or interactive elements, ensuring seamless mobile compatibility, and offering well-structured incentives collectively foster participant interest and commitment. Additionally, diligent data quality measures, such as validation checks and attention prompts, contribute to the integrity of collected information. These practical steps concretize the theoretical principles underlying web survey optimization, bridging the gap between conceptual understanding and tangible outcomes. As researchers navigate the intricacies of real-world applications, these strategies serve as guiding beacons to create meaningful, valid, and reliable research findings through web surveys.

LIMITATIONS AND DIRECTIONS FOR FUTURE STUDIES

Similar to numerous earlier investigations, the current study exhibits several limitations. To begin with, the study collected data from researchers who utilized only web surveys in research, while neglecting other researchers, hence the findings may be biased. Due to the boundness of web surveys users in research, the sample size utilized in the study was rather small. Hence, enhancing the sample size and incorporating researchers that do not exclusively rely on web surveys would augment the robustness of the findings obtained from the present study. Furthermore, while the theoretical and practical aspects are extensively explored, the dynamic nature of technology and online behavior could lead to evolving challenges not fully addressed. Additionally, the focus on web surveys may neglect potential cross-method comparisons, limiting a broader understanding of data collection approaches. Moreover, the case studies presented, while insightful, might not encompass the full spectrum of research domains, potentially overlooking specific intricacies. For future studies, delving into the interplay of emerging technologies like AI and machine learning in survey optimization could offer innovative insights. Longitudinal investigations could shed light on the sustainability of optimization strategies over time, while cross-cultural adaptations might unravel cultural nuances influencing web survey outcomes. These directions could further enrich the field by addressing these limitations and pushing the boundaries of web survey methodology.

Data Availability Statement: The authors of this work can provide the supporting data upon request.

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Conflicts of Interest: The authors declare that there are no conflicts of interest.

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Appendix A

Table A1. Survey Items.

Item	Descriptions	Source
Methodological considerations in web surveys (MC)		
MC1	Researchers need to carefully consider the survey design elements, such as visual design, survey length, question format and layout and mobile optimization, to ensure the validity and reliability of research findings.	(Dillman, Smyth, & Christian, 2014; Couper, 2000; Bethlehem, 2010; Couper 2008)
MC2	Proper sampling techniques, including random sampling or stratified sampling, should be employed to minimize bias and enhance the representativeness of the participant pool.	
MC3	Adequate attention should be given to data collection procedures, such as clear instructions, secure data transmission, data validation, timing and frequency, and privacy protection, to maintain the integrity of research findings.	
Challenges and biases associated with web surveys (CB)		
CB4	Self-selection bias can significantly impact the validity of research findings obtained through web surveys.	(Couper, 2008; Dillman, Smyth, & Christian, 2014).
CB5	Non-response bias can significantly impact the validity of research findings obtained through web surveys.	
CB6	Coverage bias can significantly impact the validity of research findings obtained through web surveys.	
CB7	Social desirability bias can significantly impact the validity of research findings obtained through web surveys.	

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CB8	Technical challenges can significantly impact the validity of research findings obtained through web surveys.	
CB9	Researchers should be cautious of potential biases when interpreting and generalizing findings from web surveys.	
Validity and reliability in web surveys (VR)		
VR10	The web survey methodology employed in this study included measures to assess and enhance the reliability of the research findings.	(Couper ,2008; Dillman, Smyth, & Christian, 2014)
VR11	The data collected through web surveys in my study demonstrated high internal consistency, indicating the reliability of the research findings	
VR12	The web survey questions in my study were designed to minimize response bias, ensuring the validity and reliability of the research findings	
VR13	The sampling technique employed in my web survey study was appropriate and representative of the target population, enhancing the validity and reliability of the research findings.	
VR14	The statistical analysis conducted on the web survey data in my study employed robust methods, contributing to the reliability and validity of the research findings.	
VR15	The findings derived from the web survey data in my study were consistent with established theories and prior research, supporting the validity and reliability of the research findings.	
VR16	The research procedures used in my web survey study were documented and transparent, ensuring the reliability and replicability of the research findings	
VR17	The limitations and potential sources of error in my web survey study were acknowledged and discussed, demonstrating the commitment to transparency and the reliability of the research findings.	

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VR18	The measures used in my web survey study were validated and demonstrated good test-retest reliability, supporting the validity and reliability of the research findings.	
VR19	The research findings obtained through web surveys in my study were considered reliable and valid by other researchers in the field, enhancing the credibility of the research findings.	
Strategies and best practices for optimizing web surveys (SBP)		
SBP20	Implementing reminder emails or follow-up communications can help improve response rates in web surveys.	(Dillman, Smyth, & Christian, 2014; Fowler Jr., 2013; Callegaro, Manfreda, & Vehovar, 2015; Toepoel, 2015; Couper, 2008)
SBP21	Using clear and concise language in survey questions can enhance participant understanding and reduce response errors.	
SBP22	Employing skip patterns or branching logic can tailor the survey experience for participants, improving engagement and data quality.	
SBP23	Offering incentives, or using personalized invitations. Consider employing multiple contact attempts to reach potential respondents.	
SBP24	Data validation checks, skip patterns, and response consistency checks.	
SBP25	Use pre-testing to identify and address any issues with the survey instrument before deployment.	
SBP26	Assure participants that their responses will be kept anonymous and confidential, adhering to ethical guidelines and data protection regulations.	
SBP27	Triangulation of data from different sources can help validate survey results.	
SBP28	Conduct pilot testing of the web survey with a small sample of respondents to identify any potential issues or areas for improvement. Iteratively refine the survey instrument based on the feedback received.	

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SBP29	Comparative analysis can help assess the consistency and reliability of the findings and identify any discrepancies or novel insights.	
SPB30	Cognitive interviewing helps identify potential problems in question wording, response options, or overall survey design that may affect the accuracy of responses in web surveys.	
SBP31	Content analysis can validate and interpret the findings derived from web survey responses.	
SBP32	Ethical considerations and informed consent can provide valid and reliable data.	
SBP33	Offer clear and concise instructions to respondents on how to complete the web survey. Provide support channels (e.g., contact information, FAQs) for participants to seek clarification or assistance if needed.	
SBP34	Implementing reminder emails or follow-up communications can help improve response rates in web surveys.	
Effectiveness of Identified Strategies and Best Practices for Optimized Web Surveys (OWS)		
OWS35	Implementing strategies to increase response rates positively impacts the validity of research findings in web surveys.	(Couper, 2008; Bethlehem, 2010)
OWS36	Following best practices for data quality assurance significantly improves the reliability of research findings in web surveys	
OWS37	The strategies and best practices identified for optimizing web surveys are effective in improving the validity and reliability of research findings.	
OWS38	Adopting the most efficient techniques in order to optimize the answer rate and the quality of the collected answers that will be optimized web surveys.	

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Guidelines and recommendations (GR) for optimizing web surveys		
GR39	Guidelines should be developed to assist researchers in addressing methodological considerations specific to web surveys.	(Tourangeau, Conrad, & Couper, 2013; Couper, 2008; Dillman, Smyth, & Christian, 2014)
GR40	Clear guidelines on survey design, question formulation, sampling, and data collection procedures would benefit researchers in web surveys.	
GR41	Recommendations should focus on improving response rates, data quality, and the overall validity of research findings in web surveys.	
GR42	Providing researchers with comprehensive guidelines will contribute to the optimization of web surveys and ensure methodological considerations and validity in their research.	