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# Modified metal float for effective levelling applications

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**Abstract:** The study aimed to design and develop a modified metal float as an efficient tool for leveling applications using the Developmental Research Method. Its primary goal was to enhance leveling performance through an improved device. The research focused on three main aspects: (1) technical specifications, (2) operating performance, and (3) acceptability. User responses were summarized using the mean, while the Wilcoxon Signed-Rank Test identified significant differences in task completion times between the traditional method and the modified float.Fifty (50) evaluators took part in the study, including 15 CAPSU professors, 10 masonry teachers, 10 civil engineers, and 15 construction workers. Acceptability was rated using a five-point scale based on design, composition, utility, portability, and safety.To assess performance, participants measured the time needed to complete a 5x7 inch wide, 1-meter-tall column, doorway, and window frame using both the traditional method and the modified float.Results showed the modified metal float earned a very high level of acceptability across all criteria. Moreover, there was a statistically significant decrease in completion time when using the modified float compared to the traditional tool.Overall, the study concludes that the modified metal float is both highly acceptable and more efficient, making it a promising tool for improving leveling tasks in construction settings.

**Keywords:** Modified, Metal Float, Leveling Application, Scraper and Rubber Float

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## INTRODUCTION

In the construction industry, the necessity for precision and efficiency in surface leveling is paramount due to the increasing expectations for high-quality finishes and the need for durability in structures. Traditional leveling methods often rely on separate tools, such as trowels and floats, which not only complicate the workflow but also contribute to time-consuming processes and increased labor costs. Each tool requires individual handling, leading to delays and potential inconsistencies in the leveling process. As construction projects become more complex and demanding in terms of accuracy, the need for innovative solutions in tool design becomes critical to meet these evolving standards. The development of multifunctional tools that streamline tasks can significantly enhance productivity, reduce costs, and ultimately contribute to the successful completion of construction projects.

Furthermore, the process of leveling surfaces is a critical step in construction that requires not only efficiency to meet tight project deadlines but also precision to ensure surfaces are smooth, even, and structurally sound. Any imperfections during leveling can compromise the quality of the final product, potentially leading to costly repairs or rework. This makes the need for reliable tools paramount, as they must consistently perform under varying conditions and material types. Innovations in construction tools, such as integrating multiple functions into a single device, address these challenges by streamlining workflows and reducing the labor

intensity involved in traditional methods. Enhancing both the quality and speed of surface preparation such advancements transform construction practices enabling professionals to achieve higher standards of efficiency and performance.

Moreover, metal floats are indispensable tools in the construction industry, particularly for leveling and finishing concrete and other surfaces. They help distribute and smooth materials to create uniform, aesthetically pleasing finishes essential for both structural integrity and functionality (Smith & Johnson, 2022). Their durable metal construction ensures they can withstand the rigorous demands of construction environments. However, traditional metal floats often require additional tools, such as scrapers, to handle excess material or address unevenness in the surface, which can increase labor requirements and slow down the overall process (Kim et al., 2023).

Scrapers, on the other hand, play a crucial role in removing excess material during surface preparation and leveling. They are designed to eliminate imperfections, ensuring that surfaces meet the required quality standards. While effective, their use as a separate tool adds complexity to the leveling process, often requiring construction workers to alternate between the float and scraper, thereby extending project timelines (Gonzalez & Rivera, 2021).

In construction settings, the researcher observed that leveling applications rely heavily on traditional tools such as metal floats and separate scrapers. While metal floats are effective in smoothing surfaces, they often require supplementary passes to address excess material or correct uneven surfaces. This reliance on multiple tools can lead to inefficiencies, including increased labor time, higher physical strain on workers, and inconsistent surface finishes. Additionally, the constant switching between a float and a scraper disrupts the workflow, making the process more tedious and time-consuming. These challenges highlight the need for tools that can streamline the leveling process while maintaining precision and quality.

While leveling tools like metal floats and scrapers are integral to construction, there is a lack of innovative designs that integrate their functions to address workflow inefficiencies. Existing studies and tools primarily focus on improving the performance of individual devices rather than combining their functionalities. This created a gap in addressing the challenges of time consumption, labor intensity, and material waste inherent in traditional methods. The integration of a scraper into a metal float has the potential to bridge this gap by offering a dual-purpose tool that simplifies leveling processes while maintaining precision and efficiency. However, research exploring the practicality, performance, and user experience of such integrated tools remains limited, emphasizing the need for this study to assess the effectiveness of this innovative approach.

The development of multifunctional tools like the modified metal float aligns well with eco-friendly construction practices. By reducing the number of tools needed and minimizing material waste, such innovations promote a more sustainable approach to construction. The researcher decided to explore the development and application of a modified metal float, a multifunctional tool designed to enhance leveling efficiency while maintaining high-quality surface finishes. By combining three essential functions, this tool can streamline the leveling process, allowing for simultaneous material smoothing and scraping. This synergy not only reduces the number of tools required on-site but also allows for a more effective workflow where the user can achieve a desired surface finish with minimal effort.

*Objectives of the study*

Generally, this study aimed to develop a modified metal float as an effective leveling application device. Specifically, it aimed to:

1. describe the technical specifications of the device in terms of design, composition, utility, portability, and safety features;
2. determine the operating performance of the device in terms of completion time using the traditional method and the developed modified metal float as leveling application device;
3. determine if there is a significant difference in the operating performance of the device in terms of completion time using the traditional method and the developed modified metal float as a leveling application device; and
4. determine the level of acceptability of the device in terms of design, composition, utility, portability, and safety features.

## METHODOLOGY

This study employed a developmental research method, focusing on the design, fabrication, and evaluation of a modified metal float tailored for efficient leveling of concrete surfaces, particularly for columns, doorways, and window frames. The tool innovatively integrates a metal float with a detachable rubber case and precision scraper, streamlining surface preparation tasks.

Guided by Priestley's (1962) criteria for tool functionality—efficiency, usability, simplicity, and cost-effectiveness—the modified float was engineered to improve time efficiency, reduce physical effort, and enhance surface leveling accuracy. Materials selected emphasized durability, ergonomic handling, and structural integrity, resulting in a lightweight yet robust design.

The fabrication process incorporated high-grade stainless steel, rubber, and wood, forming a three-in-one tool with modular features adaptable to various surface conditions. The operational process involved sequential use of the rubber float for spreading, scraper for precision correction, and metal float for final smoothing—making the tool both user-friendly and labor-saving.

Evaluation and testing were conducted in real-world construction environments, with 50 expert evaluators—including civil engineers, masonry teachers, and workers—assessing five key features: design, composition, utility, portability, and safety. The modified float consistently demonstrated superior performance, comfort, and safety, with evaluators affirming its ergonomic advantages and time-saving potential.

Data was collected using validated evaluation sheets and time trials comparing the traditional and modified tools. The mean was used to determine the acceptability ratings, while the Wilcoxon Signed-Rank Test assessed statistical significance in task completion time. Results showed that the modified float significantly improved productivity, reduced manual labor, and maintained high user satisfaction across all criteria.

In conclusion, the modified metal float is a highly effective, innovative tool that offers enhanced performance, ease of use, and ergonomic benefits for masonry professionals, proving its strong potential for adoption in modern construction practices.

## FINDINGS AND DISCUSSION

### *Technical specifications of the modified metal float*

The technical specifications of the modified metal float highlight its innovative design, durable composition, functional utility, user-friendly portability, and built-in safety featuresmaking it a reliable tool for effective levelling applications. Ergonomically designed to reduce user fatigue, the float incorporates lightweight yet sturdy materials resistant to rust, corrosion, and impact. Its integrated scraper enhances surface finishing, while the overall build ensures efficient performance across different surfaces. Compact and easy to transport, the tool suits varied work environments without sacrificing functionality. Safety is prioritized through slip-resistant grips, secure attachments, and rounded edges to prevent injury, ensuring both efficiency and protection during operation.

#### Design

The modified metal float is ergonomically designed to reduce physical strain and improve user comfort during leveling tasks. Its construction allows for smoother and faster operation, lessening the overall labor intensity required on-site. The tool's design incorporates features that ease hand strain and minimize the effort typically associated with traditional leveling methods. It promotes efficiency and enables users to work for extended periods without discomfort by reducing manual labor and fatigue.

#### Composition

The device is composed of high-quality, lightweight metals that are resistant to rust, corrosion, and impact. These materials ensure durability even under harsh environmental and working conditions. The integrated scraper and rubber components are designed not to wear down quickly, maintaining functionality over time. Its handle is made from a non-slip material that allows a firm grip, enhancing both safety and usability.

#### Utility

Functionally, the modified metal float is designed to work efficiently across various surfaces and conditions. Its built-in scraper effectively removes excess materials while ensuring a smooth, even finish. The tool reduces the number of passes needed to level surfaces, saving time and increasing precision. Whether used by skilled workers or beginners, it simplifies the leveling process and enhances work productivity. Its all-in-one functionality also means less dependency on additional tools during leveling.

#### Portability

Portability is a key advantage of the modified metal float. Its lightweight build and compact form make it easy to carry, transport, and store, even in limited space environments. The handle provides convenient grip for movement, and its structure fits comfortably in standard toolboxes. The portability does not compromise the performance of the tool, making it an ideal option for workers in mobile or multi-site construction settings. This ease of movement helps maximize efficiency on job sites.

#### Safety Features

The modified metal float incorporates several safety features to protect users during operation. Its edges are rounded to prevent accidental cuts, and the handle has a slip-resistant grip for secure handling. The scraper and rubber components are firmly attached to avoid detachment while in use.

*Operating performance of the device*

The time to complete the 5x7 inches width and 1-meter-tall column, doorway, and window frame, using the traditional method and the modified metal float is shown in Table 4 and 5. The average completion time using the modified metal float is 21.06 minutes, whereas it took 27.06 minutes using the traditional method. The results imply that the modified metal float significantly improves work efficiency compared to the traditional method. Its use allows for faster completion of tasks such as finishing columns, doorways, and window frames. This time-saving advantage suggests that the tool can enhance productivity on construction sites. It also indicates that the modified float may reduce worker fatigue and overall project duration. Its ability to shorten task completion time reflects its practicality and effectiveness in masonry work.

The modified float's ability to shorten task duration offers broader implications for workforce management and project timelines. Reduced task time translates to quicker turnover on job assignments, which decreases labor costs and allow for more efficient project scheduling. This innovation may also mitigate worker fatigue, a common issue in physically demanding tasks like masonry, thereby improving occupational health and safety.

The observed improvement in completion time when using the modified metal float aligns withthe findings of Singh and Kumar (2021) which emphasized that ergonomic tools significantly reduce physical strain and enhance productivity among masonry workers.

Similarly, the results align with the findings of Dakhil et al. (2020), who highlighted the impact of tool modifications on speeding up repetitive construction tasks while maintaining precision and consistency. These studies, together with the current results, underline the importance of innovating traditional tools to meet modern efficiency demands. The modified metal float, by decreasing task completion time from 27.06 to 21.06 minutes, not only validates these prior findings but also offers practical implications for construction projects aiming to optimize workflow, improve time management, and minimize physical fatigue among laborers.

*Significant difference in the operating performance of the device in terms of completion time*

The comparison of the time to complete the 5x7 inches width and 1-meter-tall column, doorway, and window frame, using the traditional method and the modified metal float is shown in Table 6. When a statistical analysis was conducted, at 5% level of significance, Wilcoxon Signed Ranks Test results show that there was a significant difference in the completion time between the traditional method and the modified metal float ($z = -2.807b$, $p < .005$).

The results imply that the use of the modified metal float leads to a statistically significant improvement in task completion time compared to the traditional method. The significant difference indicates that the modified tool offers a measurable advantage. This suggests that incorporating the modified metal float into masonry work can result in more time-effective operations. The statistical evidence reinforces its practical value in speeding up construction tasks. The modified float proves to be a reliable innovation for enhancing productivity in the field. Furthermore, the significant reduction in completion time further implies that construction

projects utilizing the modified metal float may benefit from lower labor costs and improved scheduling efficiency. This advantage contributed to minimizing project delays and optimizing workforce deployment, especially in large-scale or time-sensitive constructions.

Therefore, the null hypothesis which states that there is no significant difference in the operating performance of the device in terms of completion time using the traditional method and the developed modified metal float as leveling application device is hereby rejected.

*Acceptability of the modified metal float as an effective leveling application device*

The modified metal float was evaluated for acceptability across five key features: design, composition, utility, portability, and safety measures. The overall average mean rating was 4.70, interpreted as "Very Acceptable", reflecting a highly favorable assessment by masonry experts.

Portability received the highest score (4.83), indicating the tool's ease of handling, storage, and transport across different construction settings. Safety measures followed closely with a mean of 4.70, highlighting the float's secure design features that reduce injury risks and ensure safe handling.

In terms of design, the float scored 4.68, showing it is ergonomically crafted to reduce physical strain, making it suitable even for users with limited technical skills. The composition score of 4.64 affirmed the tool's durability and the quality of its materials, resistant to wear and environmental conditions. For utility, the float garnered a 4.65, confirming its effectiveness and practicality in real-world masonry applications, particularly in enhancing leveling precision and operational efficiency.

Each subcomponent received consistently high marks across all evaluation criteria, with no feature falling below the "Very Acceptable" threshold. Expert evaluations validated the tool's strong functionality, ergonomic design, and adaptability, suggesting its high potential for adoption in both professional and novice masonry environments.

## CONCLUSIONS

The modified metal float is a thoughtfully engineered tool that combines ergonomic design, durable materials, and functional efficiency to significantly improve leveling tasks in masonry and construction. Its lightweight yet robust composition resists wear and environmental damage, while the integrated scraper enhances surface finishing and reduces the effort needed to achieve smooth, precise results. Portability and user safety are also prioritized through compact sizing, slip-resistant grips, and secure components, making it practical and reliable for use across varied job sites. This tool not only speeds up work but also maintains high-quality outcomes by streamlining the leveling process and reducing physical strain, earning strong approval from experts and positioning it as a valuable asset for professionals aiming to boost productivity and safety in their projects.

The modified metal float stands out as a dependable and efficient levelling tool, thoughtfully designed with ergonomic features that significantly reduce physical strain and enhance user comfort during extended use. Its composition utilizes high-quality, lightweight metals that offer excellent resistance to rust, corrosion, and impact, ensuring long-lasting durability even in demanding work environments. Functionally, the built-in scraper improves surface finishing by allowing smoother results with fewer passes, thereby increasing productivity across different types of surfaces. The float's portability is highlighted by its compact size and

lightweight construction, making it easy to carry, transport, and use on mobile job sites without sacrificing performance. Finally, comprehensive safety features, including slip-resistant grips, rounded edges, and firmly secured components, provide reliable protection for users, ensuring safe and efficient operation throughout levelling tasks. Together, these specifications make the modified metal float a highly practical and effective tool well-suited for masonry and construction applications.

The modified metal float significantly enhances work efficiency by enabling faster completion of leveling tasks compared to traditional methods. Its innovative design and improved functionality streamline the entire process, allowing workers to perform their tasks more quickly and with greater ease. This reduction in labor time does not come at the expense of quality; instead, the tool promotes more precise and consistent results, which are crucial in construction work. The modified metal float supports increased productivity on job sites and reduces physical strain on workers by minimizing the time and effort required for leveling, contributing to a more efficient and effective workflow. These advantages make it a valuable addition to the toolkit of professionals seeking both speed and accuracy in their masonry and construction projects.

The significant difference in completion time between the traditional method and the modified metal float clearly demonstrates the superior efficiency of the modified tool. This improvement not only reflects its ability to speed up leveling tasks but also underscores its practical value in real-world construction settings. The modified metal float helps reduce labor intensity and project duration by enabling faster and more efficient work, contributing to increased productivity and better resource management on job sites. Such a marked enhancement highlights the tool's potential to become an essential asset for professionals aiming to optimize their workflow and achieve high-quality results more quickly.

The modified metal float proves to be a highly effective and reliable tool for leveling applications in the field of masonry. Its outstanding portability allows for easy handling and transportation across different work sites, while its well-designed safety features ensure protection and minimize risks during use. The ergonomic design promotes user comfort and reduces fatigue, enabling workers to perform tasks more efficiently over extended periods. Additionally, the tool's practical utility enhances productivity by providing smooth and precise finishes, and its durable composition guarantees long-lasting performance even in harsh working conditions. The strong positive evaluation from experts highlights the modified metal float as a valuable and dependable instrument that meets professional standards and supports improved work quality and safety in construction environments.

## REFERENCES

Ahmad, N., Khan, R., & Siddique, A. (2020). Multifunctional tools for construction efficiency: A case study of an integrated scraper float. Engineering Innovations Quarterly

Anderson, J., & Taylor, S. (2018). Durability in tools: Concepts and applications. Construction Materials Journal. https://doi.org/10.1016/j.cemconmat.2018.05.012

Anderson, P., & King, M. (2020). Cabinet scraper performance in smoothing uneven wood surfaces. Journal of Modern Carpentry

Barrett, T., & Frost, M. (2017). Metal floats in construction: Design, usage, and maintenance. Journal of Construction Tools. https://doi.org/10.1016/j.jct.2017.08.014

Biernacki, P., & Waldorf, D. (1981). Snowball sampling: Problems and techniques of chain referral sampling. Sociological Methods & Research.

Bradshaw, L. (2019). Sharpening and maintaining scrapers for optimal carpentry outcomes. Journal of Woodworking Maintenance

Brown, C., & Finn, R. (2020). Innovations in scraping tools for precise woodworking applications. Woodworking Science and Technology

Brown, T., & Smith, V. (2018). Material transfer and leveling efficiency with motorized scrapers in construction projects. Journal of Civil Engineering

Carver, J., & Malone, T. (2019). Effectiveness of scrapers in precise wood leveling: A comparative study. Journal of Carpentry Innovation

Clark, H., & Thompson, R. (2015). Impact of tools on construction project timelines: A case study approach.Construction Management Reviewhttps://doi.org/10.1016/j.cmrev.2015.01.002

Davis, L. (2019). Usability in construction tools: A user-centered approach. International Journal of Construction Engineering. https://doi.org/10.1016/j.ijce.2019.03.001

Garcia, T., & Ramirez, F. (2017). Effect of environmental conditions on the workability of cement-based materials. Construction and Building Materials.

Gonzalez, M., & Rivera, L. (2021). Sustainable construction practices: The role of hybrid tools in reducing material waste. Sustainable Engineering Review

Gorman, H., & Foster, L. (2019). Scrapers in modern construction: Their efficiency and impact on project timelines. Building Science Review

Green, H., & Walters, S. (2018). Enhancing surface finishes in woodworking with cabinet scrapers. Woodcraft Review

Gurbuz, F. (2018). New product development and its applications. Journal of Business and Management. https://doi.org/10.1016/j.jbm.2018.06.002

Harris, D. (2020). The role of metal floats in achieving uniform concrete surfaces. Concrete Finishing Journal

Harris, P., & Walker, J. (2016). The role of scrapers in surface finishing: Effectiveness and design considerations. Journal of Tool Technology. https://doi.org/10.1016/j.jtt.2016.04.003

Hedrick, J., & Kleiner, B. H. (2001). Ergonomics: A practical approach. Industrial Ergonomics Press.

Huang, K., & Lee, J. (2020). The role of scrapers in enhancing precision in construction leveling processes. Journal of Construction Precision

Ibbotson, G. (2017). Mastering the art of scraper use in fine carpentry. Journal of Woodworking Techniques

Jenson, T., & Larkin, S. (2020). Efficient use of scrapers for surface preparation in building projects. Journal of Building and Construction Technology

Johnson, L. (2017). Ergonomic tool designs for construction workers: Impact on efficiency and productivity. Journal of Construction Engineering and Management

Johnson, L., Williams, S., & Davis, T. (2019). Metal float use in large-scale construction projects: Efficiency and time-saving benefits. Journal of Construction Technology

Johnson, M. (2017). Effectiveness of construction tools in leveling and finishing applications. Construction Engineering Review. https://doi.org/10.1016/j.cer.2017.07.005

Jones, D. (2019). Levelling in construction: Techniques and tools for achieving precision. Journal of Construction Practices. https://doi.org/10.1016/j.jcp.2019.02.001

Kim, H., Park, S., & Lee, T. (2023). Advancing concrete leveling technology: The integrated metal float scraper. International Journal of Construction Tools and

Kucera, Ľ., Patin, B., Gajdošík, T., Palenčár, R., & Ujlaky, M. (2020). Application of metrological approaches in float level gauges for concrete surface preparation. Measurement Science Review

Larson, R., & Tucker, D. (2017). Utilizing scraping techniques for leveling irregular wood grains. Carpentry Practices Quarterly

Le, H., & Zhao, Y. (2020). Scraper-integrated levelling tools for improved cement surface finishes. Journal of Construction Technology

Lee, B. (2018). Performance impact of tool innovations on construction quality. Construction Technology Journal. https://doi.org/10.1016/j.ctj.2018.06.005

Martin, P., & Li, S. (2018). Automation in construction: Leveraging technology for improved efficiency in surface levelling. Automation in Construction

Miller, T., & McLaren, M. (2019). Labor intensity in modern construction tools: A case for innovation. Journal of Building Efficiency. https://doi.org/10.1016/j.jbe.2019.04.011

Morrison, A., & Clark, R. (2019). Technological improvements in scraper tools for building construction. Building Materials Review

Neveu, A., & Drouin, S. (2018). Advancements in construction grading tools: The role of motorized scrapers in modern construction. Journal of Construction Engineering and Management

Ngacho, C., & Das, D. (2015). A performance evaluation framework of construction projects: insights from literature. International Journal of Project Organisation and Management, 7(2), 151–173.

O'Connell, M., & Thomas, P. (2017). Scraping technologies for earth-moving and construction leveling operations. Construction Equipment Journal

O'Neill, D., & McLellan, C. (2020). Improved scraper designs for construction leveling: A comparative study of old and new models. International Journal of Construction Research, 29(1), 112-118.

Palenčár, R., Kučiak, R., & Ujlaky, M. (2020). Durability and performance of metal floats in construction applications. Journal of Building Materials

Patel, R. (2023). Innovative construction tools: A study on the impact of integrated floats. Modern Engineering Applications

Peters, G., & Campbell, D. (2017). Optimizing scraper usage for better surface finishing and leveling in construction. Construction Technology & Management

Roberts, C. (2016). Efficiency metrics in construction tools and processes. Journal of Construction Operations. https://doi.org/10.1016/j.jco.2016.06.004

Robinson, M., & Price, E. (2020). Precision scraping techniques in high-detail carpentry projects. Woodcraft Techniques Today

Smith, J., & Johnson, R. (2022). Integrated tools for enhanced construction efficiency: Development of a metal float with scraper. Journal of Construction Innovations

Smith, J., & Thomas, R. (2020). Surface preparation and cement levelling in construction projects. *Construction and Building Materials*

Taylor, G., & Nash, L. (2018). *Comparing scraping and sanding: Efficiency in carpentry projects*. Practical Woodworker's Journal

Williams, B. (2017). *Cabinet scrapers: Essential tools for modern woodworking*. Journal of Advanced Carpentry Tools

Yates, P., & Carson, R. (2021). *Leveraging scrapers for effective material handling and surface grading*. Construction Materials Journal

Chandra, R., & Shenoy, S. (2021). *Fundamentals of mobile computing*. McGraw Hill.

Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly, 13*(3), 319–340.

Evans, J. R., & Lindsay, W. M. (2017). *Managing for quality and performance excellence* (10th ed.). Cengage Learning.

ISO. (2021). *ISO/IEC 25010:2021—Systems and software engineering—Quality model for systems and software*. International Organization for Standardization.

Kotler, P., & Keller, K. L. (2019). *Marketing management* (15th ed.). Pearson Education.

National Safety Council. (2020). *Workplace safety handbook*. NSC Press.

Smith, M., & Jones, T. (2018). *Principles of material science and engineering*. Springer.

Ulrich, K. T., & Eppinger, S. D. (2020). *Product design and development* (7th ed.). McGraw Hill.