

SWARNRUDRA: An International Multidisciplinary Journal of Academic Research

<https://swarnrudrajournal.com/>

e-ISSN: 3140-0108

Publisher: Swarnrudra Publication

Vol. 1, Issue 2, August-September 2026

DOI: <https://doi.org/10.5281/zenodo.23276221>



RESEARCHARTICLE

Implementing Color-Coding for DDC Main Classes in the Academic Library to Improve Shelf Management and Reduce the Problem of Misplaced Books.

^{1*}Dr. Dashrath Singh Nag

¹Librarian Central Library AISECT University, Hazaribag, Jharkhand, India

Orcid ID: <https://orcid.org/0009-0001-4810-1594>

ABSTRACT

Effective information resources organisation and location systems are needed in academic libraries. The Dewey Decimal Classification (DDC) is used as a basis for arranging books on the shelves, but it may be difficult for users to find subject areas in the system and to locate missing books. The present study aimed at investigating the possibility of using colour coding in the main classes of DDC as another visual identification tool in an academic library. A descriptive and evaluative research design was used to evaluate the problems encountered in locating books in the library, the library experience of misplaced books, the perception of colour coding and the usefulness of shelf management. A structured questionnaire was used to obtain the views of the library users and library staff, with a structured observation of shelves conducted before and after the proposed intervention to assess the condition of the shelves. The results suggested that colour coding could facilitate recognition of material categories, help in arranging materials on shelves and help locate misplaced materials. The statistical analysis also revealed that there is a significant difference in the conditions of the shelves before and after the proposed implementation. The research results indicate that DDC colour coding is a feasible and additional visual device to be used in conjunction with DDC and call number system.

KEYWORDS :

Dewey Decimal Classification (DDC), Colour Coding, Academic Library, Shelf Management, Misplaced Books, Way finding, Visual Identification

ARTICLE HISTORY:

Received: 25.08.2026

Revised: 05.09.2026

Accepted: 15.09.2026

Published Online: 25.09.2026

CITATION

Nag, D.S., (2026). Implementing color-coding for DDC main classes in the academic library to improve shelf management and reduce the problem of misplaced books. *SWARNRUDRA: An International Multidisciplinary Journal of Academic Research*, 1(2), 50-59. <https://doi.org/10.5281/zenodo.23276221>

Introduction

Academic libraries facilitate teaching, learning and research through organized access to information resources. The use of the library is also dependent on the user's ability to access the library, move around the facility and find the information they need, as well as the availability of the collection. Research on library wayfinding has also demonstrated that wayfinding and locating relevant areas can be enhanced by presenting clear signage and visual information (Kispert, M. O., Beatty, N., Stapley, A., Bowden, H., Middleton, R., & Richardson, 2025). Signage was cited as an important feature in wayfinding in a university library by (Su, W., Lu, Z., Sun, Y., & Liu, 2022) and the need for "understandable visual communication" for various users was stressed by (Almeida, N., & Tidal, 2022). Library and Shelf Management is extremely important.

1.1 Importance of Library and Shelf Management

Good shelf management will provide systematic arrangement and retrieval of library materials. Classification systems are a

structured way of organising resources according to their subject. The DDC still continues to be well used for organizing library collections, its implementation is the support of systematic shelving (Muttaqin, K., Sakdiya, B., Almada, D. R., Febrianti, D. E., Zahroh, M., Widiarti, M., & Amalia, 2023). The ongoing evolution and significance of this are also mentioned in the modern library (Sarma, G. K., Saikia, M., & Majumder, 2026)(Ansari, B. R., & Nasir, 2024)also analyzed the DDC with other classification methods being employed in Indian libraries.

1.2 What is DDC?

The Dewey Decimal Classification (DDC) is a hierarchical system that arranges knowledge in 10 main classes (000-900). Further numerical notation is given to each class for easy reference to various subjects. This study does not propose a change to the existing classification system of DDC but introduces colour coding as a possible extra visual identification aid.

1.3 Concept of Colour Coding

Colour coding is the use of a consistent colour for each category to aid rapid visual identification. The study has found that colour distinction and colour harmony have great influence on effective wayfinding signs (Yi, J. H., & Jeon, 2022). Color can also benefit the visual search and information processing by increasing the categorization of the colour(Liu, Y., Ma, W., Guo, X., & Lin, 2021). When it comes to wayfinding in complex environments, visual cues have also been identified as a helpful assistance(Alizadeh Asli, A., Moshfeghifar, S., Mousighichi, P., & Mousavi Samimi, 2023). Thus, it may be useful to give each DDC main class a unique colour in order to encourage users to locate the subject sections more easily without losing the DDC number and subject name.(Zhang, M., Gong, Y., Deng, R., & Zhang, 2022)

1.4 Introduction to AISECT University Library

The present study is carried out in the AISECT University Library and the study is based on books classified in the ten main classes of the DDC. Library staff and users are considered together to evaluate the needs for shelf-management and usefulness of visual identification. The colour coding system proposed is intended to complement the existing DDC system by providing consistent colour indicators at relevant shelf sections.(Mandel, 2026)

2. Review of Literature

(Calista, H., Hananto, B. A., & Wijaya, 2023)did a study on the signage and wayfinding design in the Indonesian National Library. They highlighted the importance of providing clear visual information to assist users' understanding and navigation of the library space. The findings are relevant to this study as the colour coded DDC shelf markers are supposed to be used as part of the pictorial communication in the library.

(Ji, Q., 2023)performed a systematic review of factors affecting signage salience to identify factors that impact the salience of signage in indoor settings. In their review they recognized features like the visibility, distinctiveness, and environmental conditions that impact the awareness and comprehension of signs. The following are useful in designing visible and distinguishable DDC colour labels.

(Siyanbola, A. B., Oladesu, J. O., Afolabi, B. E.-I., & Uzzi, 2023)investigated using flat-design approach for wayfinding signage. Simple, clear, effective visual communication was stressed. The following principles can be used for the proposed shelf labels, which involve using the colour indicator and prominently displaying a DDC number and subject name.

(Wang, Z., Cheung, V., & Lonsdale, 2023)conducted a colour-coding study to explore the appropriate colour for information design on the map of the high-speed railway in China. They show that associations between colours and information categories are important and need to be consistent across the research. The present study suggests regular associations of colour categories for the 10 main classes of DDC.

(Wise, 2025)was a signage audit in a health library. The study provides a good example of how easily the existing signage

can be reviewed in a systematic manner and areas for improvement identified. The same evaluative process could be used with academic library shelf identification.

(Murphy, 2025) studied the role of library design and signage in aiding navigation and wayfinding in international primary school libraries. The study emphasises the correlation of the physical design of the library with the users' navigation ability. The study points to the correlation between the physical design and the effective navigation of the user in the library.

(Li, J., & Liu, 2025) explored the pedestrian wayfinding behaviour in a virtual reality indoor library environment and the impact of environment. Their study found that physical environments can impact the navigation behaviour and further support the need for research into visual identification systems in library environments.

(Park, H., & Lim, 2026) studied post-pandemic library design focusing on the space arrangement and visual accessibility for a better wayfinding. They found that there is a great need for visual information to be available in library settings. The proposed DDC colour coding system also seeks to enhance visual accessibility in that broad subject areas can be easily identified.

The literature reviewed shows that DDC offers a structured framework for organizing the library and research on signage, wayfinding and colour coding prove the role of visual cues in physical information environments is beneficial. But there is little research that has specifically looked at the application of the colour coding of all the 10 main classes as a complementary library shelf-management measure in an academic library.

3. Research Objectives & Hypothesis

3.1 Statement of the Problem

DDC offers the system in which the books are arranged, but it can be challenging to find a book or a section of a book explaining the subject. Books that are out of place may also cause issues with getting books properly shelved. Accordingly, the study suggests that colour coding of the ten main classes of DDC as another visual aid would help in identification of books, book shelf management and detection of misplaced books.

3.2 Objectives

To evaluate the problem of finding books and arrangement of books with the present DDC scheme. To create colour coding as a visual identification tool for the ten main classes of the DDC. To measure misplaced books and to correct the location of books before and after colour-coding before and after the implementation. To evaluate the attitude and acceptance of the library users and staff for the proposed colour coding system.

3.3 Hypothesis

H₀ (Null Hypothesis): Before and after the implementation of DDC colour coding, there is a significant difference in the misplacement of the books and correct shelving.

H₁ (Alternative Hypothesis): Before and after the application of DDC colour coding, there is a significant difference in book misplacement and correct shelving.

Chi-Square Test

Chi-square test is used to indicate if the difference between observed and expected frequencies is statistically significant

$$\chi^2 = \sum \frac{(O - E)^2}{E}$$

4. Research Methodology



Fig 4.1. Methodology Framework

4.1 Research Design

The study was a descriptive and evaluative research. Existing DDC shelf arrangement was evaluated by a questionnaire and structured observation. The idea was then to adopt a colour coding system for the ten DDC main classes and assess the usefulness of the system for book identification and shelf management.

4.2 Area of Study

The study was undertaken in AISECT University Library. The study concerned books that are grouped based on the ten main classes of the DDC (000-900) and the opinions of the library staff and users.

4.3 Sample & Population

The study was conducted with a total of 56 respondents, with 36 being the library users while the remaining 20 were library staff. Shelf-level observation also was taken into consideration before and after the proposed colour coding intervention to assess correct and misplaced books.

Table 4.1. Sample Distribution of Respondents

Respondent Category	Frequency	Percentage
Library Staff	20	35.7%
Library Users	36	64.3%
Total	56	100%

4.4 Data Collection Tools (Questionnaire, Observation)

Two tools were used for data collection:

Questionnaire: The structured questionnaire was given to library staff and users to examine the extent to which DDC is known to them, the problems encountered in locating books, their perception of the usefulness of colour coding, the benefits they anticipate in using DDC for retrieval and their general acceptance of DDC.

Observation: A structured shelf-observation format was followed in collecting the DDC numbers, subject sections, shelving status and presence of colour labels. Same shelf areas were chosen for before and after comparison.

4.5 Proposed Colour Chart (000–900)

The proposed colour scheme assigns a distinct colour to each DDC main class to provide an additional visual identification cue.

Table 4.2. Proposed Colour-Coding Scheme for DDC Main Classes

DDC	Main Class	Proposed Colour
000	Generalities / Computer Science	White
100	Philosophy & Psychology	Light Yellow
200	Religion	Orange
300	Social Sciences	Red
400	Language	Light Green
500	Science	Dark Green
600	Technology	Blue
700	Arts & Recreation	Pink
800	Literature	Maroon
900	History & Geography	Black

4.6 Implementation Process in LMS

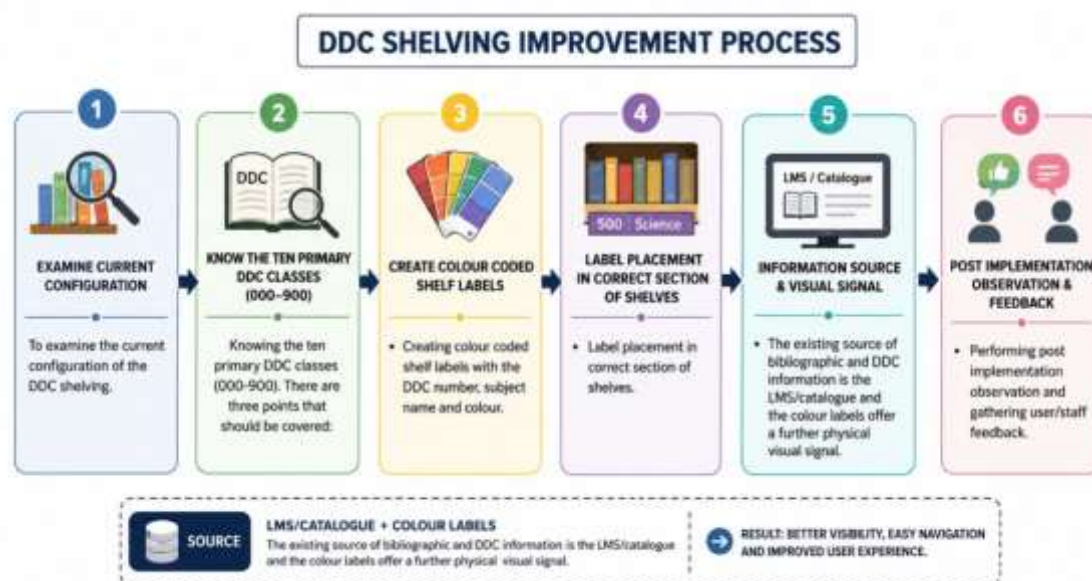


Fig 4.2 Implementation process in LMS

The use of the proposed colour coding system was to be in addition to existing library arrangement and not in lieu of DDC numbers or call numbers. The process of implementation included:

1. To examine the current configuration of the DDC shelving.
2. Knowing the ten primary DDC classes (000–900). There are three points that should be covered:
3. Creating colour coded shelf labels with the DDC number, subject name and colour.
4. Label placement in correct section of shelves.
5. The existing source of bibliographic and DDC information is the LMS/catalogue and the colour labels offer a further physical visual signal.
6. Performing post implementation observation and gathering user/staff feedback.

5. Data Analysis & Interpretation

5.1 Staff Questionnaire Analysis

The total number of respondents in the study was 56 with 20 respondents being staff of the library (35.7%). As can be seen in the chart of the respondents, the library staff made up a significant proportion of the study sample. They give a staff view on current shelf management practices and the value of a system of easy visual identification for the arrangement in DDC.

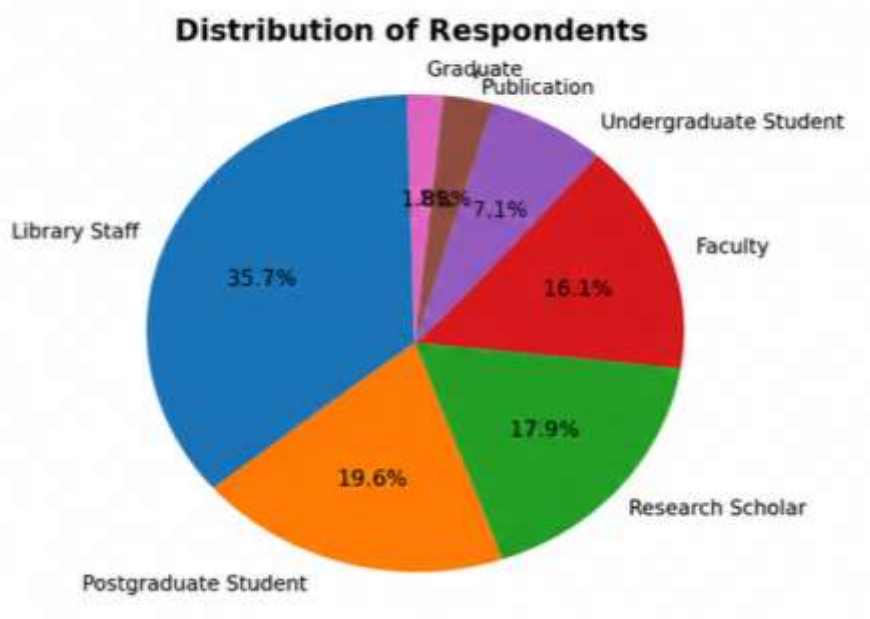


Figure 5.1: Distribution of Respondents

Interpretation:

20 library staff members and 36 library users participated in the study. The total sample consisted of 35.7% of the library staff who gave their professional opinion about the organisation and management of shelves and 64.3% of the users of the library.

5.2 Users Questionnaire Analysis

The study involved 36 users of the library which accounts to the 64.3% of the total 56 respondents. The user responses were interpreted as an understanding of their experience of finding books and having books assigned to an incorrect or unexpected shelf section.

The misplaced-book experience analysis revealed that respondents were exposed to misplaced or books that were unexpectedly shelved at different frequency rates.

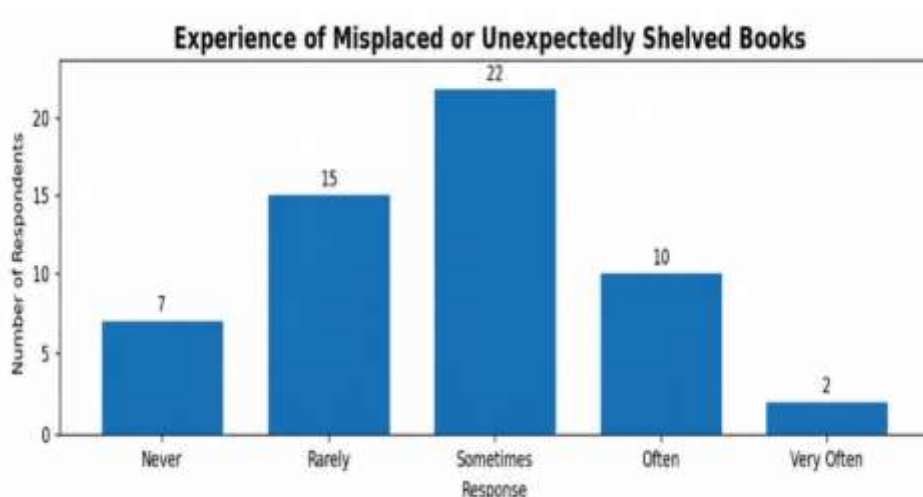


Figure 5.2: Frequency of Encountering Misplaced or Unexpectedly Shelved Books

Interpretation

The findings show that 22 of the respondents (39.3%) at times found books shelved in an inappropriate or unexpected location. Another 10 (17.9%) said this happens frequently and 2 (3.6%) said it happens very frequently. Therefore, a significant percentage of the respondents had some type of challenge due to inappropriate or unexpected shelving. This was another finding that reinforces the need for another visual identification in addition to the current DDC arrangement.

5.3 Before vs After Colour Coding

The misplacement rate was compared before and after implementation of the proposed DDC colour-coding system.

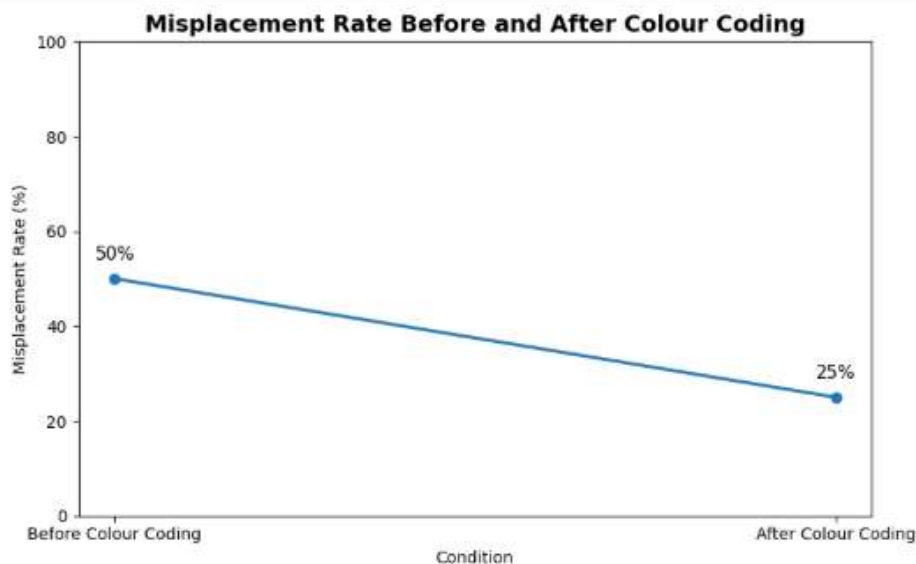


Figure 5.3: Misplacement Rate Before and After Colour Coding

Interpretation

Prior to colour coding, 28 books were correctly shelved and 28 books were classified as misplaced books, giving a 50% misplacement rate. Following implementation, there was a drop of 25% in misplaced books and a rise of 75% in correctly shelved books.

Therefore:

- The percentage of correct shelving rose by 25 points.
- The percentage of misplacement fell by 25%.
- The misplacement rate decreased by 50% when compared to the before condition.
- The findings suggest that the colour coding system proposed could be a valuable visual aid to aid in the identification of shelves and finding misplaced books.

These results indicate that the proposed colour-coding system may serve as a useful supplementary visual aid for improving shelf identification and detecting misplaced books.

5.4 Hypothesis Testing (Chi-Square)

The chi-square test was applied to examine whether there was a significant difference between shelving status before and after implementation of the proposed colour-coding system.

Hypotheses

- **H₀:** There is no significant difference in book misplacement and correct shelving before and after implementation of DDC colour coding.
- **H₁:** There is a significant difference in book misplacement and correct shelving before and after implementation of DDC colour coding.

Table 5.1: Chi-Square Test Result

Comparison	χ^2	df	p-value	Decision
Before vs After Colour Coding	6.44	1	0.0112	Reject H ₀

Expected Frequencies

Condition	Correctly Shelved	Misplaced
Before Colour Coding	35	21
After Colour Coding	35	21

Interpretation

The chi-square test yielded a value of $\chi^2 = 6.44$, p-value = 0.0112, and 1 degree of freedom. The p value is less than the level of significance (0.05) so the null hypothesis is rejected.

Therefore, the analysis indicates a statistically significant difference in shelving status before and after implementation of the proposed DDC colour-coding system.

6. Findings, Suggestions And Conclusion

6.1 Findings of the Study

A total of 56 respondents were used for the study, which included 20 library staff (35.7%) and 36 library users (64.3%). The results show that the topic is relevant in the academic library with regard to misplaced and unexpected shelved books. Within those who responded, 22 (39.3%) said that they sometimes had to find misplaced books or books they didn't expect to be shelved, 10 (17.9%) said that they often found misplaced books or books that they didn't expect to be shelved, and 2 (3.6%) said they very often found misplaced books or books they didn't expect to be shelved. Prior to the implementation of the proposed colour coding system, 50% (28) of the 56 books were correctly shelved and 50% (28) were misplaced. Following the implementation, 42 (75%) of books were shelved correctly, and 14 (25%) of books were misplaced. Thus, correct shelving increased by 25 percentage points, while the misplacement rate decreased by 25 percentage points. The chi-square test resulted in a value of $\chi^2 = 6.44$ with 1 degree of freedom and a p-value of 0.0112, which is less than the commonly accepted significance level of 0.05, suggesting that there is a statistically significant difference between the shelving status before and after implementation of the proposed colour-coding system. The results indicate that colour coding can be a useful visual aid to enhance shelf identification, as well as to help with the management of shelves and to locate misplaced books.

6.2 Suggestions

The result of the study suggests that the suggested colour coding system could be used as an additional visual classification tool to the current DDC classification system. Each of the ten main classes of DDC should be represented by a consistent colour and this should be used in the appropriate subjects sections throughout. Colour-coded shelf labels should include the corresponding DDC number, subject name and the colour to ensure all users easily understand and access the system. Shelves and racks should be clearly marked with labels and users should be given a short orientation on the meaning of the colours. During their normal work in the library the colour coded labels may also serve as a further visual reminder to library staff for normal operations and book arranging duties. Colour should not be the sole way of identifying the system, and alternative text should be

included for people with colour vision problems at all times. It is also recommended that the system be periodically evaluated based on user feedback and shelf observation to track the effectiveness of the system.

6.3 Conclusion

The study suggests the proposed colour coding system for the ten main classes of the DDC can be used as a simple visual aid for academic library shelf management. The comparison between the before and after revealed that the number of books shelved correctly increased from 50% to 75% while the number of misplaced books decreased from 50% to 25%. This was confirmed by the chi-square test ($\chi^2 = 6.44$, $df = 1$, $p = 0.0112$). Thus, the idea of colour coding will have the potential to aid in the recognition of the parts of the subject and help identify misplaced books. Colour coding is to be used as a secondary system and should not be used in place of the existing DDC numbers or call-number system.

References

1. Alizadeh Asli, A., Moshfeghifar, S., Mousighichi, P., & Mousavi Samimi, P. (2023). Adults' visual cue preferences and wayfinding abilities in healthcare centers. *HERD: Health Environments Research & Design Journal*, 16(3), 104–118.
2. Almeida, N., & Tidal, J. (2022). Library wayfinding and ESOL students: Communication challenges and empathy-based intervention. *portal: Libraries and the Academy*, 22(2), 453–474.
3. Ansari, B. R., & Nasir, M. (2024). A comparative study of Dewey Decimal Classification (DDC) and Colon Classification in Indian libraries. *International Education and Research Journal*, 10(6). <https://doi.org/10.5281/zenodo.15718707>
4. Ji, Q., et al. (2023). A systematic review of factors influencing signage salience in indoor environments. *Sustainability*, 15(18), 13658.
5. Kispert, M. O., Beatty, N., Stapley, A., Bowden, H., Middleton, R., & Richardson, M. (2025). Visual signage and academic library wayfinding. *LIBER Quarterly*, 35(1), 1–60.
6. Li, J., & Liu, C. (2025). Analysis of pedestrian wayfinding under herd effect in VR fire evacuation at indoor library: Gender difference considered. *Frontiers in Psychology*, 16, 1558115.
7. Liu, Y., Ma, W., Guo, X., & Lin, X. (2021). Impacts of color coding on programming learning in multimedia learning: Moving toward a multimodal methodology. *Frontiers in Psychology*, 12, 773328.
8. Mandel, L. H. (2026). Can I find it? Secret shopper study of wayfinding ease in public library facilities. *Journal of Librarianship and Information Science*.
9. Murphy, J. (2025). An investigation into how library design and signage support children's navigation and wayfinding in international primary school libraries. *Reflective Professional*, 5.
10. Muttaqin, K., Sakdiya, B., Almaida, D. R., Febrianti, D. E., Zahroh, M., Widiarti, M., & Amalia, R. (2023). Implementasi sistem klasifikasi Dewey Decimal Classification (DDC) di perpustakaan Sekolah Dasar. *Jurnal Pembelajaran Pemberdayaan Masyarakat*, 4(2),
11. Park, H., & Lim, H. (2026). Post-pandemic library design: Spatial configuration and visual accessibility for enhanced wayfinding. *Journal of Asian Architecture and Building Engineering*.
12. Sarma, G. K., Saikia, M., & Majumder, A. J. (2026). The Dewey Decimal Classification in the 21st century: A study based on the transformation in the last two and a half decades. *Journal of Indian Library Association*, 62(1), 150–158.
13. Siyanbola, A. B., Oladesu, J. O., Afolabi, B. E.-I., & Uzzi, F. O. (2023). Adapting flat design concept in digital graphics to wayfinding signage development: Redirecting movement and recreating the environment. *VCD: Journal of Visual Communication Design*, 8(1).
14. Su, W., Lu, Z., Sun, Y., & Liu, G. (2022). Let eyes tell: Experimental research on university library signage system and users' wayfinding behavior. *Library Hi Tech*, 40(1), 198–221.

15. Wang, Z., Cheung, V., & Lonsdale, M. (2023). Effective colors for information design: A color-coding study of China's high-speed railway map. *Information Design Journal*, 27(2), 191–212.
16. Wise, K. (2025). You can go your own way: Conducting a signage audit in a health library. *Health Information & Libraries Journal*, 42(4), 489–499.
17. Yi, J. H., & Jeon, J. (2022). A study on color conspicuity and color harmony of wayfinding signs according to outdoor environment types. *Color Research & Application*, 47(5), 1259–
18. Zhang, M., Gong, Y., Deng, R., & Zhang, S. (2022). The effect of color coding and layout coding on users' visual search on mobile map navigation icons. *Frontiers in Psychology*, 13, 1040533.
19. Calista, H., Hananto, B. A., & Wijaya, A. M. S. (2023). Signage & wayfinding design for the Indonesian National Library. *Journal Bahasa Rupa*, 7(1), 43–57.

COPYRIGHT:

© 2026 The Author(s). This is an open-access article distributed under the terms of the Creative Commons Attribution 4.0 International License (CC-BY 4.0), which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited. See <http://creativecommons.org/licenses/by/4.0/>