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# Effectiveness of Flipbook-Based E-Jobsheets on Students' Practical Competence in Zigzag Hair Perming Design

Wisri Ardhita Manda Putri[1*], Habibah Hanim Lubis[2], Fitri Amaliyah Batubara[3], Irmiah Nurul Rangkuti[4]
Mei Alsih Sihombing[5], Putri Chairina Zulfiani[6]
Universitas Negeri Medan, Indonesia
e-mail: wisriardhita@unimed.ac.id*, HabibahLubis@unimed.ac.id, fitriamaliyah@unimed.ac.id, irmiahnurul@unimed.ac.id, meialsihsihombing@unimed.ac.id, putrichairin@unimed.ac.id

**ABSTRACT**

*The integration of digital learning media in vocational education is essential to enhance students' practical competence, particularly in cosmetology. This study examines the effectiveness of flipbook-based e-jobsheets in improving students' competence in zigzag hair perming design. A quantitative quasi-experimental design with a pretest–posttest control group was applied to 56 undergraduate students, divided into an experimental group (n = 28) and a control group (n = 28). The experimental group used flipbook-based e-jobsheets, while the control group used conventional job sheets. Data was collected through performance-based assessments and analyzed using descriptive statistics, normalized gain, and independent samples t-test. The results show that the experimental group achieved significantly higher posttest scores than the control group, with a high normalized gain (g = 0.72) compared to a moderate gain in the control group (g = 0.33). The difference was statistically significant (p < 0.05) with a large effect size (d = 1.83). These findings indicate that flipbook-based e-jobsheets effectively enhance students' practical competence and support more engaging, student-centered vocational learning.*

***Keywords:*** *Flipbook E-Jobsheets, Vocational Education, Practical Competence, Cosmetology Education, Digital Learning Media.*

**ABSTRAK**

*Pengintegrasian media pembelajaran digital dalam pendidikan vokasi sangat penting untuk meningkatkan kompetensi praktis siswa, khususnya dalam bidang tata rias. Penelitian ini mengkaji efektivitas lembar kerja elektronik berbasis flipbook dalam meningkatkan kompetensi siswa dalam desain pengeritingan rambut zigzag. Desain kuasi-eksperimental kuantitatif dengan kelompok kontrol pretest–posttest diterapkan pada 56 mahasiswa sarjana, yang dibagi menjadi kelompok eksperimen (n = 28) dan kelompok kontrol (n = 28). Kelompok eksperimen menggunakan lembar kerja elektronik berbasis flipbook, sedangkan kelompok kontrol menggunakan lembar kerja konvensional. Data dikumpulkan melalui penilaian berbasis kinerja dan dianalisis menggunakan statistik deskriptif, gain yang dinormalisasi, dan uji t sampel independen. Hasil menunjukkan bahwa kelompok eksperimen mencapai skor posttest yang secara signifikan lebih tinggi daripada kelompok kontrol, dengan gain yang dinormalisasi tinggi (g = 0,72) dibandingkan dengan gain sedang pada kelompok kontrol (g = 0,33). Perbedaan tersebut secara statistik signifikan (p < 0,05) dengan ukuran efek yang besar (d = 1,83). Temuan ini menunjukkan bahwa lembar kerja elektronik berbasis flipbook secara efektif meningkatkan kompetensi praktis siswa dan mendukung pembelajaran kejuruan yang lebih menarik dan berpusat pada siswa.*

***Kata kunci:*** *Lembar Kerja Elektronik Berbasis Flipbook, Pendidikan Kejuruan, Kompetensi Praktis, Pendidikan Kosmetologi, Media Pembelajaran Digital*

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## INTRODUCTION

The rapid advancement of digital technologies has significantly transformed vocational education, demanding innovative instructional media that not only deliver content but also enhance students' practical competence (Ellianawati, et al. 2026; Halomoan, et al. 2024; Yomaki, et al. 2023). In the context of beauty and cosmetology education, particularly in specialized skills such as zigzag hair perming design, traditional instructional approaches often rely on printed job sheets and teacher demonstrations (Fitria, et al. 2024; Kharomah, et al. 2024). While these methods provide foundational guidance, they frequently lack interactivity, visual richness, and flexibility, which are essential for mastering complex procedural skills. Consequently, there is a growing need to integrate digital learning media that can effectively support skill acquisition in practice-oriented disciplines (Rahmiati, et al. 2023; Trisnawati, et al. 2025).

One promising innovation is the use of flipbook-based e-jobsheets, which combine the structured guidance of conventional job sheets with multimedia elements such as animations, step-by-step visuals, and interactive navigation (Hidayat, et al. 2024; Iwan, et al. 2026). Flipbook technology enables learners to access instructional materials in a more engaging and self-paced manner, thereby fostering independent learning and deeper understanding of procedural tasks (Putri, et al. 2026; Salzabila, et al. 2024). In vocational

settings, where psychomotor skills and procedural accuracy are critical, such digital enhancements can bridge the gap between theoretical instruction and hands-on practice (br Limbong, et al. 2026; Hakiki, et al. 2024; Purnomo, et al. 2025).

Previous studies have demonstrated that digital learning media, including e-modules and interactive simulations, can improve student engagement, motivation, and learning outcomes (Mustaqim, et al. 2026; Martin, et al. 2026). However, limited research has specifically examined the effectiveness of flipbook-based e-jobsheets in the domain of hairdressing education, particularly for intricate techniques such as zigzag hair perming design. This technique requires precision, creativity, and a clear understanding of sequential processes, making it an ideal context for evaluating the impact of interactive digital instructional tools (Halomoan, et al. 2024; Hakiki, et al. 2024; Teferi, et al 2026).

Furthermore, the integration of flipbook-based learning aligns with contemporary pedagogical approaches that emphasize student-centered learning, self-regulated learning, and the use of technology to enhance experiential learning. By providing rich visual demonstrations and accessible learning resources, flipbook e-jobsheets have the potential to support students in mastering practical competencies more effectively than traditional media (Saputri, et al. 2025; Sari, et al. 2024; Simarmata, et al. 2026).

Despite these potential benefits, empirical evidence regarding their effectiveness in improving students' practical competence remains scarce. Therefore, this study aims to investigate the effectiveness of flipbook-based e-jobsheets on students' practical competence in zigzag hair perming design (Suriyah, et al. 2026; Susanto, et al. 2022). Specifically, this research seeks to evaluate whether the use of such digital learning media can significantly enhance students' performance in practical tasks compared to conventional instructional methods.

The findings of this study are expected to contribute to the advancement of digital pedagogy in vocational education, particularly in cosmetology, by providing evidence-based insights into the design and implementation of interactive instructional media. Moreover, this research offers practical implications for educators in developing more effective learning resources that support skill mastery in complex, practice-oriented subjects.

## METHOD

### A. Research Design

This study employed a quantitative experimental approach using a quasi-experimental design to examine the effectiveness of flipbook-based e-jobsheets on students' practical competence in zigzag hair perming design. Specifically, a pretest–posttest control group design was implemented to compare learning outcomes between students who utilized flipbook-based e-jobsheets (experimental group) and those who used conventional job sheets (control group). The experimental design can be represented as follows:

Experimental Group: $O_1$ x $O_2$

Experimental Group: $O_1$ - $O_2$

Where:

$O_1$ = Pretest score

$O_2$ = Posttest score

$X$ = Treatment using flipbook-based e-jobsheets.

This design enables the measurement of changes in students' practical competence before and after the intervention, as well as comparison between groups.

### B. Sample

The sample of this study consisted of 56 undergraduate students enrolled in the Cosmetology Education Program at Universitas Negeri Medan. The sampling technique used was purposive sampling, considering that the selected participants had prior exposure to basic hair treatment courses and were currently undertaking practical training in hair perming techniques. The participants were divided into two groups: Experimental group: 28 students, Control group: 28 students. This grouping ensured comparability in terms of academic level and prior knowledge.

### C. Data Analysis Technique

The data analysis was conducted using descriptive and inferential statistics to evaluate the effectiveness of the intervention. The normality of the data distribution was tested using the Kolmogorov–Smirnov test. The homogeneity of variance between groups was examined using Levene's test.

1. Gain Score Analysis

To measure the improvement in students' competence, the normalized gain (g) was calculated as follows:

$$g = \frac{X_{post} - X_{pre}}{X_{max} - X_{pre}}$$

Where:
$X_{post}$ = Posttest score
$X_{pre}$ = Pretest score
$X_{max}$ = Maximum possible score

The gain score was interpreted as: $g > 0.7$ = High improvement, $0.3 < g < 0.7$ = Moderate improvement, $g < 0.3$ = Low improvement

2. Hypothesis Testing (Independent Samples t-test)

To determine the significance of differences between the experimental and control groups, an independent samples t-test was applied:

$$t = \frac{\bar{X}_1 - \bar{X}_2}{\sqrt{\frac{S_1^2}{n_1} + \frac{S_2^2}{n_2}}}$$

Where:
$\bar{X}_1, \bar{X}_2$= Mean scores of experimental and control groups
$S_1^2, S_2^2$= Variances of the two groups
$n_1, n_2$= Sample sizes

The decision criterion was based on a significance level of $\propto$ = 0.005 If $p$ < 0.05, the null hypothesis was rejected, indicating a statistically significant difference between groups.

3. Effect Size (Cohen's d)

To assess the magnitude of the treatment effect, Cohen's d was calculated:

$$d = \frac{\bar{X}_1 - \bar{X}_2}{S_p}$$

Where:

$$S_p = \sqrt{\frac{(n_1 - 1)S_1^2 + (n_2 - 1)S_2^2}{n_1 + n_2 - 2}}$$

Interpretation of effect size:
$d = 0.2$= Small effect
$d = 0.5$= Medium effect
$d \geq 0.8$= Large effect

## RESULTS AND DISCUSSION

### A. Descriptive Statistics

Descriptive analysis was conducted to provide an overview of students' practical competence in zigzag hair perming design before and after the intervention.

Table 1. Descriptive Statistics of Pretest and Posttest Scores

| Group | N | Mean Pretest | SD Pretest | Mean Posttest | SD Posttest |
|---|---|---|---|---|---|
| Experimental | 28 | 62.14 | 6.85 | 85.36 | 5.92 |
| Control | 28 | 61.79 | 7.02 | 74.18 | 6.47 |

The results indicate that both groups had relatively similar pretest scores, suggesting comparable initial competence. However, the posttest mean score of the experimental group (85.36) was substantially higher than that of the control group (74.18), indicating a stronger improvement after the use of flipbook-based e-jobsheets.

### B. Normality and Homogeneity Testing

Prior to hypothesis testing, assumptions of normality and homogeneity were examined.

Table 2. Normality Test Results (Kolmogorov–Smirnov)

| Group | Test | Statistic | Sig. (p) |
|---|---|---|---|
| Experimental | Pretest | 0.112 | 0.200 |
| Experimental | Posttest | 0.105 | 0.200 |
| Control | Pretest | 0.118 | 0.174 |
| Control | Posttest | 0.109 | 0.200 |

All significance values were greater than 0.05, indicating that the data were normally distributed.

Table 3. Homogeneity Test Results (Levene's Test)

| Variable | Levene Statistic | Sig. (p) |
|---|---|---|
| Posttest | 1.284 | 0.262 |

The significance value exceeded 0.05, confirming that the variance between groups was homogeneous.

### C. Gain Score Analysis

To evaluate the magnitude of improvement, normalized gain scores were calculated.

Table 4. Normalized Gain (N-Gain) Analysis

| Group | Mean N-Gain | Category |
|---|---|---|
| Experimental | 0.72 | High |
| Control | 0.33 | Moderate |

The experimental group achieved a high level of improvement $(g = 0.72)$, while the control group showed only moderate improvement $(g = 0.33)$, This suggests that the flipbook-based e-jobsheets were more effective in enhancing practical competence.

### D. Hypothesis Testing

An independent samples t-test was conducted to determine whether the difference between groups was statistically significant.

Table 5. Independent Samples t-test Results

| Variable | Mean (Exp) | Mean (Ctrl) | t-value | df | Sig. (p) |
|---|---|---|---|---|---|
| Posttest | 85.36 | 74.18 | 6.87 | 54 | 0.000 |

The results show a significant difference between the experimental and control groups ($t = 6.87,\ p < 0.05$). Therefore, the null hypothesis is rejected, indicating that the use of flipbook-based e-jobsheets significantly improves students' practical competence.

## E. Effect Size Analysis

To determine the magnitude of the treatment effect, Cohen's d was calculated.

Table 6. Effect Size (Cohen's d)

| Comparison | Cohen's d | Interpretation |
|---|---|---|
| **Experimental vs Control** | **1.83** | **Large Effect** |

The effect size (d = 1.83) indicates a very large effect, demonstrating that the intervention had a substantial impact on students' practical competence.

## F. Discussion

This study demonstrates that flipbook-based e-jobsheets significantly improve students' practical competence in zigzag hair perming design compared to conventional job sheets (Putri et al., 2026; Salzabila et al., 2024). The findings confirm that integrating interactive digital media into vocational education can effectively enhance skill acquisition in practice-oriented learning environments.

The superior performance of the experimental group can be explained through the Technological Pedagogical Content Knowledge (TPACK) framework, which emphasizes the integration of technology, pedagogy, and subject content in effective teaching (Eliza, et al. 2024; Halomoan et al. 2026). In this study, flipbook-based e-jobsheets functioned not only as technological tools but also as pedagogical supports for delivering procedural content in zigzag hair perming design. The multimedia features embedded in the flipbooks, including dynamic visualization, step-by-step procedural demonstrations, and flexible navigation, enabled lecturers to present complex practical content more systematically and interactively (Agraini et al., 2026; Fauziyyah et al., 2026). This indicates that the effectiveness of flipbook-based learning lies in the alignment between digital technology, instructional strategies, and vocational content knowledge.

From a pedagogical perspective, the results are also consistent with Constructivism learning theory, which posits that learning in digital environments occurs through interaction with multiple information sources, technological tools, and networks. In the flipbook environment, students were able to independently access instructional materials, review procedural steps repeatedly, and connect visual information with hands-on practice (Agraini et al. 2026; Fadli et al. 2024). This learner autonomy supports self-regulated learning and allows students to construct procedural understanding through continuous interaction with digital resources (Iwan et al., 2026; Rais et al., 2025; Yomaki et al., 2023). Unlike conventional printed job sheets, which provide static information, flipbook-based e-jobsheets offer a more connected learning experience by enabling students to navigate learning materials according to their individual pace and needs.

The high normalized gain score observed in the experimental group further indicates that the improvement was substantial rather than incremental. This finding suggests that digital flipbook media not only improve immediate task performance but also strengthen procedural comprehension and practical confidence. The learner-controlled features of the e-jobsheets encourage repeated practice, reflection, and independent error correction, which are essential in vocational skill development (Saputri et al., 2025; Sari et al., 2024; Simarmata et al., 2026).

Moreover, the statistically significant difference between groups, supported by a large effect size, highlights the strong educational impact of the intervention. These findings extend previous research on digital learning media by demonstrating that technology-enhanced instructional materials can be highly effective even in tactile and hands-on disciplines such as cosmetology education. This is particularly relevant for vocational institutions seeking to modernize practical instruction through digital transformation.

Despite these contributions, several limitations should be acknowledged. The study was conducted with a relatively limited sample from a single institution, which may restrict the generalizability of the findings. In addition, the intervention focused on a specific competency area, namely zigzag hair perming design. Future studies should involve more diverse vocational contexts, larger samples, and longitudinal designs to examine long-term impacts on skill retention and professional readiness.

Overall, flipbook-based e-jobsheets represent an effective and scalable instructional innovation for enhancing practical competence in vocational education. Viewed through the lenses of TPACK and connectivism, the findings suggest that the successful integration of technology in vocational learning depends not only on digital tools themselves, but also on how these tools facilitate pedagogically meaningful, connected, and learner-centered experiences.

## CONCLUSSION

This study examined the effectiveness of flipbook-based e-jobsheets in enhancing students' practical competence in zigzag hair perming design within a vocational education context. The findings provide strong empirical evidence that the integration of interactive digital job sheets significantly outperforms conventional instructional methods. The experimental group achieved higher posttest scores and demonstrated substantially greater learning gains, as indicated by the normalized gain and large effect size. These results confirm that flipbook-based e-jobsheets are effective pedagogical tools for supporting procedural understanding and skill mastery. The integration of multimedia elements, structured instructional guidance, and learner-controlled navigation promotes active engagement, deeper comprehension, and more accurate execution of complex practical tasks. Thus, digital job sheets function not merely as supplementary materials but as transformative learning media that effectively bridge theoretical knowledge and hands-on practice. From a practical standpoint, this study underscores the potential of flipbook-based e-jobsheets to modernize vocational education, particularly in cosmetology and other skill-oriented disciplines. Their implementation can enhance instructional effectiveness, foster learner autonomy, and support more flexible and sustainable learning environments in line with ongoing digital transformation in education. However, the study is limited by its relatively small sample size and its focus on a single institution and specific competency area, which may restrict the generalizability of the findings. Future research should involve more diverse samples, broader vocational domains, and longitudinal designs to examine long-term impacts on skill retention and professional readiness. In conclusion, flipbook-based e-jobsheets represent a highly effective and scalable instructional innovation with significant potential to improve practical competence and advance the quality of vocational education in the digital era.

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