**Journal of Informatics and Vocational Education (JOIVE)**
Vol.8, No.3, Nov 2025, pp. 32~36
ISSN: 2746-7813 

# Enhancing Students' Motivation in Algorithm Learning through Web-Based Visual Diagramming Tools: An ARCS Model Analysis

**Nahila Sibta Nadia[1], Aris Budianto[2], Basuki Sri Wibowo[3]**
[1] Department of Teacher Professional Education, Universitas Sebelas Maret
[2] Department of Informatics Education, Universitas Sebelas Maret
[3] SMA Negeri 1 Kartasura

**Article Info**

***Article history:***

Received Jun 26, 2025
Revised Oct 20, 2025
Accepted 1 Nov, 2025

***Corresponding Author:***

Aris Budianto,
Department of Informatics Education, Universitas Sebelas Maret,
Jl Ahmad Yani, no 200,
Pabelan, Kartasura, Surakarta,
Central Java, 57169, Indonesia.
Email:
arisbudianto@staff.uns.ac.id

**ABSTRACT**

Learning algorithms and flowchart design in secondary informatics education often lack engaging instructional strategies that effectively foster students' learning motivation. However, limited studies have examined how web-based visual diagramming tools influence students' motivational dimensions in algorithm learning within the ARCS framework. This study provides empirical evidence on how web-based diagramming tools enhance motivational engagement in algorithm learning. A qualitative descriptive design was employed involving 36 tenth-grade students. The findings reveal that visual interaction through draw.io significantly increased students' attention and engagement, improved contextual relevance of learning tasks, strengthened learners' confidence in constructing flowcharts independently, and generated positive learning satisfaction. These findings extend the application of the ARCS model within web-based informatics instruction and highlight the potential of digital visual tools to enhance affective learning outcomes. Integrating digital visual media into informatics instruction can serve as an effective strategy to enhance students' motivation and engagement in computational learning.

**Keywords:** Flowchart, Learning Motivation, Visual Media

## 1. INTRODUCTION

In the digital era, students no longer simply require informative learning materials, but also interactive, visual learning experiences that are relevant to their daily lives. However, in the practical application of informatics learning, particularly in algorithms and flowchart design, many students still demonstrate low engagement and motivation(Alruwais & Zakariah, 2023). Motivation is a key factor in determining the success of the learning process. Winata (2021) states that motivation is an internal or external force that can drive someone to achieve certain goals. Without motivation, understanding basic concepts such as algorithms, will struggle to develop optimally (Syudirman & Saddam, 2021).

Algorithms are the foundations of computational thinking and the basis for program development(Critten et al., 2025). One way to represent algorithms is through flowcharts, diagrams used to illustrate logical flows systematically(Kuo & Zhuo, 2024). However, the theoretical presentation of flowcharts and their manual design often makes it difficult for students to grasp the concepts and discourage active participation(Ngadengon et al., 2025). This situation requires teachers to integrate visual learning media with more interactive and contextual content. These limited visualizations tend to make students less interested and ultimately lead to low motivation for learning. This presents a challenge for teachers to find learning solutions that are not only effective in delivering material but also visually appealing and appropriate to the characteristics of today's students, who are closely connected to digital technology (Gani & Saddam, 2020).

Previous studies have shown that interactive learning media can increase student participation and learning outcomes. Putra dan Salsabila (2021) emphasize that interactive learning increases student engagement in the learning process. Similarly, Rosidah et al. (2022) and Afrilia et al. (2022) found that interactive media positively impact cognitive learning outcomes. Previous studies primarily focused on cognitive outcomes rather than examining motivational dimensions. Previous studies have also shown that the use of visual media in learning can increase student motivation and enthusiasm for learning(Angelova et al., 2025). The implementation of visual media has been proven to increase student engagement in the learning

process, resulting in a significant increase in their motivation to learn (Roni et al., 2021). In addition, the use of visual media is also effective in increasing student motivation in other subjects with contextual and visual material characteristics (Meliana et al., 2025).

In addition, the use of web-based visual diagramming tools such as draw.io in flowchart learning has rarely been specifically studied in the context of improving student learning motivation, especially using the comprehensive ARCS motivation analysis framework developed by Keller (1985) which offers a systematic approach to measuring motivation through four indicators: Attention, Relevance, Confidence, and Satisfaction. This approach allows for a more focused analysis of the affective aspects of students in digital learning. Based on the description above, there is a gap in research that specifically analyzes the effectiveness of draw.io-based interactive visual media on student learning motivation using the ARCS model as an analytical framework. Therefore, this study aims to examine how the integration of the draw.io visual diagramming tool influences students' learning motivation based on the four ARCS dimensions: Attention, Relevance, Confidence, and Satisfaction. This study contributes to literature in two ways. First, it extends the application of the ARCS motivational model within digital informatics learning environments. Second, it provides empirical evidence on how web-based diagramming tools support motivational engagement in algorithm instruction.

## 2. RESEARCH METHOD

This study uses a descriptive qualitative approach with field research aimed at analyzing student learning motivation using draw.io-based visual learning media with ARCS model indicators. A qualitative descriptive approach was employed to capture students' motivational behavior during classroom learning activities. Participants consisted of 36 tenth-grade students from a public senior high school in Central Java, Indonesia. The sampling technique used was saturated sampling, so that the entire population was used as research subjects, consisting of 36 students, comprising 16 male students and 20 female students. Details of the participants are presented in Table 1.

Table 1. Participants

| Participant | Gender | Total |
|---|---|---|
| Students | Male | 16 |
| | Female | 20 |

The procedures in this study included (1) planning visual-based learning using draw.io; (2) implementing learning; (3) observing students' motivational behavior during learning; and (4) collecting and grouping data from observations and documentation. Data collection techniques included direct observation and documentation. Observations were conducted using structured observation sheets compiled based on the ARCS model indicators, namely Attention, Relevance, Confidence, and Satisfaction(Dornyei, 2014; Sun, 2025). The ARCS model was chosen because it provides a systematic framework for analyzing student learning motivation and helps teachers design motivating learning activities (Adzikra et al., 2025). Documentation in the form of students' flowchart designs and learning activities was used as supporting data.

The main instrument of this study was a learning motivation observation sheet compiled based on ARCS indicators. The observation sheet was adjusted to the focus of the study and used to observe student behavior during the learning process. The observation data were then used as the basis for analysis to assess the effectiveness of draw.io in increasing student learning motivation. The instruments used in this study are presented in Table 2.

Table 2 Observation Sheet Instrument

| No | Aspect | Indicator |
|---|---|---|
| 1 | Attention | Students pay attention to the teacher's explanation |
| | | Students engage in discussions/question and answer sessions |
| 2 | Relevance | Students can relate the material to real-world or digital contexts |
| | | Students show interest in learning. |
| 3 | Confidence | Students show the courage to try making their own flowcharts without asking many questions. |
| | | Students complete the flowchart assignment thoroughly. |
| 4 | Satisfaction | Students provide positive feedback about their learning experience. |
| | | Students show expressions of happiness or satisfaction after completing the assignment. |

The data preprocessing stage was carried out through data reduction, grouping based on four ARCS indicators, and presenting the data in a descriptive narrative form. Data analysis used interactive qualitative analysis techniques, which included data reduction, data presentation, and concluding(Sari, 2025). To ensure data validity, this study also applied data triangulation in the form of technical triangulation, source triangulation, and time triangulation(Mutanga, 2024). Technical triangulation was carried out by utilizing two data collection methods, namely observation and documentation. Source triangulation was carried out through student involvement in both types of data. Time triangulation was carried out by collecting data during morning lessons. With this procedure, this study aims to analyze the effectiveness of draw.io-based visual learning in increasing the learning motivation of grade X E4 students in the subject of algorithms and flowchart design.

## 3. RESULT AND ANALYSIS

Algorithm learning and flowchart design were conducted using draw.io media for students in class X E4. This study aimed to analyze the effectiveness of draw.io-based visual learning in increasing student learning motivation based on the ARCS (Attention, Relevance, Confidence, Satisfaction) model developed by John M. Keller (1985). Based on the data analysis using the ARCS model extracted from the data, the results are presented in Table 3.

Table 3. Results of observations on the development of learning motivation among students in class X E4

| No | Aspect | Observation results | Behavior indicators |
|---|---|---|---|
| 1 | Attention | Students' attention increases when visual media is used | Focus on the teacher, active discussion |
| 2 | Relevance | Students are able to relate the material to real life | Creating flowcharts of daily activities |
| 3 | Confidence | Students' confidence develops | Daring to try and correct mistakes |
| 4 | Satisfaction | Students show satisfaction with learning | Positive and enthusiastic expressions |

Overall, the use of draw.io had a positive impact on all four aspects of learning motivation. In terms of attention, students showed focus when the teacher demonstrated how to use the application and actively participated in discussions. This study agrees with Raida et al., (2025) that visual stimulus variation and interactive learning methods are very effective in attracting and maintaining students' attention. These findings are also reinforced by research by Mayasari et al., (2023) which states that the use of visual technology-based learning media can increase student concentration and engagement in the learning process in the classroom. The findings suggest that integrating web-based visual diagramming tools can enhance student engagement in computational learning.

In terms of relevance, students are able to connect the concept of flowcharts with their daily activities. This supports the view of Susanti dan Imbiri, (2020) that personally relevant learning will increase students' connection with the material. Athilah et al., (2024) also emphasize that relevance helps students understand the practical meaning of learning content. Additionally, research by Fauziah et al., (2024) shows that contextual learning based on real-world problems significantly improves students' perception of the meaningfulness of the material.

From the confidence aspect, students appear to be brave enough to try making flowcharts independently and actively ask questions when they encounter difficulties. This attitude may indicate a sense of competence that has developed during learning. This is in line with the ARCS concept (Keller, 1985) that self-confidence arises when students experience gradual success in completing tasks. Wulan (2021) also states that active involvement and experiences of success can strengthen students' self-confidence. Research by Hayati dan Pratama, (2025) states that the use of interactive digital media provides space for independent exploration that can increase students' self-efficacy.

In terms of satisfaction, most students showed expressions of satisfaction and enthusiasm after completing the task. Positive feedback from teachers also reinforced this sense of achievement. This is in line with the opinion of Yulianti et al., (2019) who stated that learning satisfaction can be obtained through positive reinforcement and appreciation of student achievement(Wang et al., 2025). In line with this, research by Hardani, (2026) states that giving appreciation and experiences of success in technology-based learning increases student satisfaction and self-motivation. Thus, the results of this study indicate that draw.io-based

visual learning is effective in increasing student learning motivation on the four ARCS indicators. This study has practical implications that the integration of interactive visual media in informatics learning can increase student engagement and motivation effectively. Theoretically, the results of this study reinforce the application of the ARCS model in the context of digital technology-based learning and expand the study of learning motivation in the affective aspect.

## 4. CONCLUSION

This study aims to analyze the effectiveness of draw.io-based visual learning in increasing student learning motivation in algorithm and flowchart design material using the ARCS model framework developed by John M. Keller (1985). Based on the results of this study, it can be concluded that the application of draw.io media is effective in increasing the learning motivation of students in class X E4 in the four aspects of ARCS, namely Attention, Relevance, Confidence, and Satisfaction. Students showed attention during learning, were able to relate the material to real-life contexts, had confidence in designing flowcharts, and showed satisfaction with the learning process and outcomes. This study confirms that the research objectives have been achieved, while also filling the gap in previous studies that focused more on cognitive aspects. This study emphasizes the affective aspect, namely learning motivation, with a structured approach through the ARCS model. Thus, this study contributes theoretically to strengthening the application of the ARCS model in digital media-based informatics learning and, practically, provides alternative learning strategies that are more interactive and contextual.

However, this study has several limitations. First, the study was only conducted in one class with a limited number of subjects, so the results obtained are still contextual and cannot be generalized widely. Second, the approach used was descriptive qualitative and did not use measurable quantitative scales or instruments, so the increase in student motivation could not be analyzed as numerical data. Given these limitations, future research should use a mixed methods approach with quantitative instruments to measure motivation levels more accurately, involve a broader sample, and compare the effectiveness of draw.io with other digital learning media. Further research could also explore the long-term impact of using visual media on students' computational learning outcomes.

## REFERENCES

Adzikra, A. N., Hermanto, R., Santika, S., Keguruan, F., & Siliwangi, U. (2025). *Efektivitas Model Pembelajaran ARCS terhadap Kemampuan Pemecahan Masalah Matematis Siswa*. *7*(2), 1797–1806.

Afrilia, L., Neviyarni, Arief, D., & Amini, R. (2022). Efektivitas Media Pembelajaran Berbasis Video Animasi Untuk Meningkatkan Motivasi Belajar Peserta Didik Kelas Iv Sekolah Dasar. *Jurnal Cakrawala Pendas*, *8*(3), 710–721. https://doi.org/10.31949/jcp.v8i3.2559

Alruwais, N., & Zakariah, M. (2023). Student-Engagement Detection in Classroom Using Machine Learning Algorithm. *Electronics (Switzerland)*, *12*(3). https://doi.org/10.3390/electronics12030731

Angelova, D., Stoykov, T., Tabakova, V., Lyubenov, D., Konetsovska, E. N., & Sofianska, A. M. (2025). Exploring Opportunities for More Effective Acquisition and Interpretation of New Knowledge by Students in the Field of Architectural Visualization Through Multimedia Learning. *Education Sciences*, *15*(9). https://doi.org/10.3390/educsci15091105

Athilah, F. S., Wardana, L. A., Kadriyanto, D. Y., & Sriwijayanti, R. P. (2024). *Implementasi Model Pembelajaran ARCS ( Attention , Relevance , Confidence , Satisfaction ) untuk Menumbuhkan Motivasi Belajar pada Pembelajaran IPAS Kelas V SDN Karanganyar 1*. *4*, 1871–1881.

Critten, V., Hagon, H., Critten, S., & Messer, D. (2025). Developing Computational Thinking Abilities in the Early Years Using Guided Play Activities. *Education Sciences*, *15*(10), 1–22. https://doi.org/10.3390/educsci15101298

Dornyei, J. H. and Z. (2014). *Motivating Learning by Zoltán Dörnyei, Jill Hadfield (z-lib.org).pdf*.

Fauziah, I., Zainal, M. N., & Fadilah, L. (2024). Penerapan Pembelajaran Kontekstual Untuk Meningkatkan Minat Belajar Siswa. *Berkala Ilmiah Pendidikan*, *4*(2), 330–341.

Gani, A. A., & Saddam, S. (2020). Pembelajaran Interaktif Pendidikan Kewarganegaraan Melalui Mobile Learning di Era Industri 4.0. *CIVICUS : Pendidikan-Penelitian-Pengabdian Pendidikan Pancasila Dan Kewarganegaraan*, *8*(1), 36. https://doi.org/10.31764/civicus.v8i1.1849

Hardani, A. (2026). Dampak Pembelajaran Berbasis Teknologi Terhadap Motivasi Belajar Siswa. *Tarbiyatul Ilmu: Jurnal Kajian Pendidikan*, *3*(4), 518–523.

Hayati, I. K., & Pratama, A. (2025). TOFEDU : The Future of Education Journal The Effect of Digital

Learning Media Usage on Digital Economic Literacy with Self-Efficacy as an Intervening Variable among Students of SMA Negeri 62 Jakarta. *TOFEDU: The Future of Education Journal*, *4*(7), 2734–2748.

Keller, J. M. (1985). *Development and Use of the ARCS Model of Instructional Design*. *1932*.

Kuo, Y. C., & Zhuo, M. J. (2024). The Effect of Flipped Classroom Integrated with the POEWSQ Learning Model on Programming Learning. *Applied Sciences (Switzerland)*, *14*(22). https://doi.org/10.3390/app142210468

Mayasari, A., Pujasari, W., Ulfah, & Arifudin, O. (2023). PENGARUH MEDIA VISUAL PADA MATERI PEMBELAJARAN. *Jurnal Tahsinia (Jurnal Karya Umum Dan Ilmiah)*, *2*(2), 173–179.

Meliana, M., Kalang, T., & Iswahyudi, D. (2025). *Jurnal Ilmiah Pendidikan Citra Bakti PEMANFAATAN MEDIA PEMBELAJARAN BERBASIS AUDIO VISUAL DALAM MENINGKATKAN MOTIVASI BELAJAR SISWA*. *12*, 508–521.

Mutanga, M. B. (2024). Students' Perspectives and Experiences in Project-Based Learning: A Qualitative Study. *Trends in Higher Education*, *3*(4), 903–911. https://doi.org/10.3390/higheredu3040052

Ngadengon, Z., Subramaniam, T. S., Yasak, Z., Ideris, N. A., & Mohd Ramly, Z. (2025). Evaluating the Difficulties in Programming Learning: Insights from Polytechnic Students. *International Journal of Academic Research in Progressive Education and Development*, *14*(1), 1051–1065. https://doi.org/10.6007/ijarped/v14-i1/24518

Putra, A. D., & Salsabila, H. (2021). Pengaruh Media Interaktif Dalam Perkembangan Kegiatan Pembelajaran Pada Instansi Pendidikan. *Inovasi Kurikulum*, *18*(2), 231–241. https://doi.org/10.17509/jik.v18i2.36282

Raida, Malisi, M. A. S., & Aghnaita. (2025). *Penerapan Model ARCS ( Attention , Relevance , Confidance , Satisfaction ) Pada Mata Pelajaran PAI Untuk Meningkatkan Motivasi Belajar Siswa Kelas XI 7 Di SMAN 1 Palangka Raya*. *8*, 37–48.

Roni, M., Karenia, P. M., Juhaeni, Ninik, M., & Safaruddin. (2021). Implementasi Media Visual Dalam Meningkatkan Semangat Belajar Siswa Kelas IV MI Nahdatul Ulama ' Ngingas Waru Sidoarjo. *Journal of Instructional and Development Researches*, *1*(3), 130–135.

Rosidah, Nizaar, M., Sintayana Muhardini, H., & Yuni Mariyati. (2022). Efektifitas Media Pembelajaran Game interaktif Berbasis Power Point Untuk Meningkatkan Motivasi Belajar Siswa Kelas V SD. *Seminar Nasional Paedogoria*, *2*(2020), 17–23.

Sari, S. P. (2025). *The analysis of liquidity and profitability ratios to assess financial distress potential in the balken wood business in Piabung Village*. *13*(2), 126–132.

Sun, S. (2025). Designing Gamified Intergenerational Reverse Mentorship Based on Cognitive Aging Theory. *Multimodal Technologies and Interaction*, *9*(6). https://doi.org/10.3390/mti9060064

Susanti, L., & Imbiri, C. (2020). Implementasi Motivasi Model ARCS (Attention, Relevance, Confidence, and Satisfaction) dalam Pembelajaran Pendidikan Agama Kristen. *DUNAMIS: Jurnal Teologi Dan Pendidikan Kristiani*, *4*(2), 254–263. https://doi.org/10.30648/dun.v4i2.284

Syudirman, S., & Saddam, S. (2021). Pendampingan Belajar Dari Rumah Untuk Meningkatkan Semangat Belajar Siswa Di Era Pandemi Covid-19. *JCES (Journal of Character Education Society)*, *4*(4), 914–922.

Wang, M., Ramasamy, S. S., Dawod, A. Y., & Yu, X. (2025). Development and TAM-Based Validation of a User Experience Scale for Actual System Use in Online Courses. *Education Sciences*, *15*(7), 1–31. https://doi.org/10.3390/educsci15070855

Winata, I. K. (2021). Konsentrasi dan Motivasi Belajar Siswa terhadap Pembelajaran Online Selama Masa Pandemi Covid-19. *Jurnal Komunikasi Pendidikan*, *5*(1), 13. https://doi.org/10.32585/jkp.v5i1.1062

Wulan, D. K. (2021). *PENERAPAN MODEL PEMBELAJARAN ARCS ( ATTENTION , RELEVANCE , CONFIDANCE , SATISFACTION ) UNTUK MENINGKATKAN MOTIVASI BELAJAR DAN KEMAMPUAN KOGNITIF SISWA PADA MATERI HUKUM NEWTON KELAS X SMA*. *3*(2).

Yulianti, Y., Murdani, E., & Kusumawati, I. (2019). Pengaruh Penerapan Model Pembelajaran Attention, Relevance, Confidence, Satisfaction (ARCS) terhadap Motivasi Belajar dan Hasil Belajar Siswa pada Materi Kalor di Kelas X. *Variabel*, *2*(1), 24. https://doi.org/10.26737/var.v2i1.1029