

**PENGEMBANGAN *VIRTUAL REALITY* UNTUK MENINGKATKAN  
KEMAMPUAN *COMPUTATIONAL THINKING* SISWA**

**SKRIPSI**

diajukan untuk memenuhi salah satu syarat memperoleh gelar Sarjana Pendidikan  
Program Studi Pendidikan Ilmu Komputer



oleh

Rival Swandy Irawan

NIM 1901321

**PROGRAM STUDI PENDIDIKAN ILMU KOMPUTER  
DEPARTEMEN PENDIDIKAN ILMU KOMPUTER  
FAKULTAS PENDIDIKAN MATEMATIKA DAN ILMU PENGETAHUAN  
ALAM  
UNIVERSITAS PENDIDIKAN INDONESIA  
2023**

**PENGEMBANGAN *VIRTUAL REALITY* UNTUK MENINGKATKAN  
KEMAMPUAN *COMPUTATIONAL THINKING* SISWA**

oleh

Rival Swandy Irawan

NIM 1901321

Sebuah Skripsi yang diajukan untuk memenuhi salah satu syarat memperoleh gelar Sarjana pada Program Studi Pendidikan Ilmu Komputer

© Rival Swandy Irawan 2023

Universitas Pendidikan Indonesia

Desember 2023

Hak Cipta dilindungi Undang-Undang

Skripsi ini tidak boleh diperbanyak seluruhnya atau sebagian, dengan dicetak ulang, difotokopi, atau cara lainnya tanpa izin dari penulis

**RIVAL SWANDY IRAWAN**

**PENGEMBANGAN *VIRTUAL REALITY* UNTUK MENINGKATKAN  
KEMAMPUAN *COMPUTATIONAL THINKING* SISWA**

disetujui dan disahkan oleh pembimbing:

Pembimbing I



**Dr. Budi Laksono Putro, M.T.**

NIP. 197607102010121002

Pembimbing II



**Erlangga, M.T.**

NIP. 198607082018031001

Mengetahui,

Ketua Program Studi Pendidikan Ilmu Komputer



**Prof. Dr. Lala Septem Riza, M.T.**

NIP. 197809262008121001

**PENGEMBANGAN *VIRTUAL REALITY* UNTUK MENINGKATKAN  
KEMAMPUAN *COMPUTATIONAL THINKING* SISWA**

oleh:

Rival Swandy Irawan - [rival@upi.edu](mailto:rival@upi.edu)

1901321

**ABSTRAK**

Kurikulum merdeka merupakan kurikulum baru yang dirancang untuk menjawab tantangan di abad 21. Salah satu perubahan yang terjadi adalah penambahan mata pelajaran informatika. Dalam mempelajari informatika, termasuk mata pelajaran jurusan di RPL dan TKJ, membutuhkan pemecahan masalah dari sistem komputasi yang disebut dengan *computational thinking* (CT). Adapun materi yang ingin ditingkatkan CT-nya adalah materi yang dianggap sulit oleh siswa. Penelitian ini dilakukan kepada siswa yang baru menginjak kelas XI TKJ 3 di SMK Negeri 5 Bandung. Setelah dilakukan studi lapangan, didapat materi *OSI Layer* merupakan materi yang sulit untuk dipelajari oleh siswa. Penelitian dilakukan dengan tujuan untuk merancang pembelajaran model *contextual teaching and learning* (CTL) berbasis *virtual reality* (VR) sehingga dapat terjadi peningkatan dalam kemampuan CT siswa dalam memecahkan persoalan *OSI Layer*. Metode penelitian dirancang menggunakan *Smart Learning Environment Establishment Guideline* (SLEEG) dengan desain penelitian *One Group Pretest Posttest*. Berdasarkan penelitian yang telah dilakukan melalui uji *paired t test* menunjukkan peningkatan signifikan dari pembelajaran model CTL berbasis VR terhadap CT siswa. Penelitian ini pun berhasil membuktikan peningkatan CT di beberapa komponen dengan skor *n-gain*: 23% abstraksi, 51% dekomposisi, 40% pengenalan pola, dan 46% berpikir algoritma. Tanggapan siswa terhadap pembelajaran model CTL berbasis VR menunjukkan hasil yang positif dengan nilai persentase 89% yang berkategori “Sangat Baik”. Dapat disimpulkan bahwa penerapan pembelajaran model CTL berbasis VR dapat meningkatkan *computational thinking* siswa.

**Kata Kunci:** *Computational Thinking, Contextual Teaching & Learning, Virtual Reality, OSI Layer, Smart Learning Environment Establishment Guideline*

**DEVELOPING VIRTUAL REALITY TO ENHANCE STUDENTS'  
COMPUTATIONAL THINKING SKILLS**

*Arranged by*

*Rival Swandy Irawan - [rival@upi.edu](mailto:rival@upi.edu)*

*1901321*

**ABSTRACT**

*"Kurikulum Merdeka" is a new curriculum designed to address challenges in the 21st century. One of the changes implemented is the addition of the informatics subject. In studying informatics, including subjects in the RPL (Network Engineering) and TKJ (Computer and Network Installation) majors, it requires problem-solving skills from computational systems known as computational thinking. The focus of improvement in computational thinking is on topics considered difficult by students. This research was conducted among students entering the 11th grade in TKJ 3 at SMK Negeri 5 Bandung. After conducting field studies, it was found that the OSI Layer material was challenging for students to grasp. The research aims to design a Contextual Teaching and Learning (CTL) model based on Virtual Reality (VR) to enhance students' computational thinking skills in solving OSI Layer problems. VR is used as a research tool, and the desired outcomes include an improvement in computational thinking and student responses to the VR-based CTL model. The research method is designed using the Smart Learning Environment Establishment Guideline (SLEEG) with a One Group Pretest Posttest research design. Based on the research, the paired t-test shows a significant improvement in students' computational thinking through the VR-based CTL model. The study successfully demonstrated an increase in computational thinking in several components with n-gain scores: 23% for abstraction, 51% for decomposition, 40% for pattern recognition, and 46% for algorithmic thinking. Student responses to the VR-based CTL model showed positive results with a percentage of 89%, categorized as "Very Good." In conclusion, the implementation of the VR-based CTL model can enhance students' computational thinking.*

**Keywords:** *Contextual Teaching & Learning, Virtual Reality, OSI Layer, Computational Thinking, Smart Learning Environment Establishment Guideline*

## DAFTAR ISI

|  |      |
|--|------|
| LEMBAR PERNYATAAN.....   | iv   |
| KATA PENGANTAR .....   | v    |
| UCAPAN TERIMA KASIH.....   | vi   |
| ABSTRAK.....   | viii |
| <i>ABSTRACT</i> .....  | ix   |
| DAFTAR ISI.....  | x    |
| DAFTAR TABEL.....  | xiii |
| DAFTAR RUMUS .....   | xv   |
| DAFTAR GAMBAR .....  | xvi  |
| DAFTAR LAMPIRAN.....   | xvii |
| BAB I PENDAHULUAN .....  | 18   |
| 1.1 Latar Belakang Penelitian .....                                | 18   |
| 1.2 Rumusan Masalah .....  | 24   |
| 1.3 Batasan Masalah.....   | 25   |
| 1.4 Tujuan Penelitian .....  | 25   |
| 1.5 Manfaat Penelitian .....                                       | 26   |
| 1.6 Sistematika Pelaporan Skripsi.....                             | 27   |
| BAB II KAJIAN PUSTAKA.....   | 29   |
| 2.1 Peta Literatur.....  | 29   |
| 2.2 <i>Computational Thinking</i> .....                            | 30   |
| 2.2.1 Pengertian <i>Computational Thinking</i> .....               | 30   |
| 2.2.2 Komponen <i>Computational Thinking</i> .....                 | 31   |
| 2.2.3 Praktik <i>Computational Thinking</i> pada pembelajaran..... | 33   |
| 2.3 <i>Virtual Reality</i> .....                                   | 35   |

|                                    |   |     |
|------------------------------------|---|-----|
| 2.3.1                              | Pengertian <i>Virtual Reality</i> (VR) .....                        | 35  |
| 2.3.2                              | Jenis <i>Virtual Reality</i> (VR).....                              | 36  |
| 2.3.3                              | Praktik <i>Virtual Reality</i> pada pembelajaran .....              | 38  |
| 2.4                                | <i>Contextual Teaching and Learning</i> .....                       | 39  |
| 2.4.1                              | Pengertian Contextual Teaching and Learning (CTL) .....             | 39  |
| 2.4.2                              | Komponen Contextual Teaching and Learning (CTL).....                | 40  |
| 2.4.3                              | Praktik Contextual Teaching and Learning pada pembelajaran<br>40    |     |
| 2.5                                | <i>Smart Learning Environment Establishment Guideline</i> (SLEEG) . | 43  |
| 2.6                                | <i>State of the Art</i> .....                                       | 45  |
| BAB III METODOLOGI PENELITIAN..... |   | 48  |
| 3.1                                | Metode Penelitian.....  | 48  |
| 3.2                                | Desain Penelitian.....  | 48  |
| 3.3                                | Prosedur Penelitian.....  | 50  |
| 3.3.1                              | <i>Analyze</i> (Analisis).....                                      | 51  |
| 3.3.2                              | <i>Design</i> (Desain) .....  | 53  |
| 3.3.3                              | <i>Development</i> (Pengembangan) .....                             | 55  |
| 3.3.4                              | <i>Implement</i> (Implementasi) .....                               | 63  |
| 3.3.5                              | <i>Evaluate</i> (Evaluasi).....                                     | 65  |
| 3.4                                | Populasi dan Sampel .....   | 71  |
| BAB IV TEMUAN DAN PEMBAHASAN ..... |   | 72  |
| 4.1                                | Hasil Penelitian .....  | 72  |
| 4.1.1                              | Tahap <i>Analyze</i> (Analisis).....                                | 72  |
| 4.1.2                              | Tahap <i>Design</i> (Desain) .....                                  | 79  |
| 4.1.3                              | Tahap <i>Development</i> (Pengembangan) .....                       | 88  |
| 4.1.4                              | Tahap <i>Implementation</i> (Implementasi).....                     | 106 |

|  |     |
|--|-----|
| 4.1.5 Tahap <i>Evaluation</i> (Evaluasi) ..... | 109 |
| 4.2 Pembahasan.....                            | 119 |
| BAB V KESIMPULAN DAN SARAN.....                | 123 |
| 5.1 Kesimpulan .....                           | 123 |
| 5.2 Saran.....                                 | 124 |
| DAFTAR PUSTAKA .....                           | 126 |
| LAMPIRAN.....                                  | 133 |



## DAFTAR TABEL

|  |     |
|--|-----|
| Tabel 3.1 Desain <i>One Group Pretest-Posttest</i> .....                 | 49  |
| Tabel 3.2 Aspek Penilaian LORI pada Materi.....                          | 56  |
| Tabel 3.3 Aspek Penilaian LORI pada Media.....                           | 57  |
| Tabel 3.4 Klasifikasi Perhitungan Nilai Validasi oleh Ahli.....          | 58  |
| Tabel 3.5 Kartu Soal untuk Validasi Ahli.....                            | 59  |
| Tabel 3.6 Kriteria Koefisien Validitas.....                              | 60  |
| Tabel 3.7 Kriteria interpretasi reliabilitas.....                        | 61  |
| Tabel 3.8 Kriteria Indeks Kesukaran.....                                 | 62  |
| Tabel 3.9 Kriteria Daya Pembeda.....                                     | 62  |
| Tabel 3.10 Kriteria Tingkat Korelasi aspek TAM.....                      | 64  |
| Tabel 3.11 Tanggapan Peserta Didik Terhadap Media.....                   | 64  |
| Tabel 3.12 Tabel Kriteria Uji Gain berdasarkan Nilai G.....              | 68  |
| Tabel 3.13 Indikator CTL terhadap CT.....                                | 69  |
| Tabel 3.14 Konversi tanggapan terhadap kriteria skor.....                | 70  |
| Tabel 3.15 Klasifikasi Nilai Hasil Tanggapan Siswa Terhadap Media.....   | 71  |
|  |     |
| Tabel 4.1 Media yang Diharapkan pada Pembelajaran <i>OSI Layer</i> ..... | 76  |
| Tabel 4.2 Desain Kegiatan Pembelajaran.....                              | 83  |
| Tabel 4.3 Hasil Validasi Ahli Materi.....                                | 89  |
| Tabel 4.4 Hasil Analisis Instrumen Soal.....                             | 91  |
| Tabel 4.5 Hasil Persentase Kriteria Validitas Soal.....                  | 94  |
| Tabel 4.6 Hasil Persentase Kriteria Kesukaran Soal.....                  | 95  |
| Tabel 4.7 Hasil Persentase Kriteria Daya Pembeda.....                    | 96  |
| Tabel 4.8 Antarmuka Media.....   | 99  |
| Tabel 4.9 <i>Blackbox Testing</i> .....                                  | 103 |
| Tabel 4.10 Hasil Validasi Media oleh Ahli.....                           | 106 |
| Tabel 4.11 Hasil Uji Normalitas Kolmogorov-Smirnov.....                  | 109 |
| Tabel 4.12 Hasil Uji <i>Paired T-Test</i> .....                          | 110 |
| Tabel 4.13 Hasil Uji <i>N-Gain</i> tiap Kelompok.....                    | 111 |
| Tabel 4.14 Hasil Uji <i>N-Gain</i> Untuk Tiap Komponen CT.....           | 112 |
| Tabel 4.15 Hasil Analisis CTL terhadap CT Abstraksi.....                 | 113 |

|  |     |
|--|-----|
| Tabel 4.16 Hasil Analisis CTL Tahap 2 terhadap CT Dekomposisi .....  | 114 |
| Tabel 4.17 Hasil Analisis CTL Tahap 3 terhadap CT Berpikir Algoritma | 116 |
| Tabel 4.18 Hasil Tanggapan Siswa Terhadap Media .....                | 117 |

## DAFTAR RUMUS

|   |    |
|---|----|
| Rumus 3.1 Presentase skor kategori data .....                 | 58 |
| Rumus 3.2 Uji validitas dengan <i>Bivariate Pearson</i> ..... | 59 |
| Rumus 3.3 Rumus reliabilitas dengan formulasi KR-21 .....     | 60 |
| Rumus 3.4 Indeks Kesukaran .....                              | 61 |
| Rumus 3.5 Uji daya pembeda .....                              | 62 |
| Rumus 3.6 Rumus Uji Normalitas dengan K-S.....                | 66 |
| Rumus 3.7 Uji <i>paired-t-test</i> .....                      | 67 |
| Rumus 3.8 <i>n-Gain</i> .....                                 | 68 |
| Rumus 3.9 Presentase Kategori Data.....                       | 70 |

## DAFTAR GAMBAR

|   |     |
|---|-----|
| Gambar 2.1 Peta Literatur.....  | 29  |
| Gambar 2.2 SLEEG berdasarkan ISO 21001:2018 dan ADDIE.....                  | 44  |
| <br>  |     |
| Gambar 3.1 Prosedur Penelitian dengan SLEEG.....                            | 50  |
| Gambar 3.2 Prosedur Penelitian tahap <i>Analyze</i> (Analisis).....         | 51  |
| Gambar 3.3 Prosedur Penelitian tahap <i>Design</i> (Desain).....            | 53  |
| Gambar 3.4 Rancangan Model CTL berbasis VR untuk CT.....                    | 55  |
| Gambar 3.5 Interval Kategori Hasil Validasi Ahli.....                       | 58  |
| Gambar 3.6 Prosedur Penelitian tahap <i>Implement</i> (Implementasi).....   | 63  |
| Gambar 3.7 Skema TAM.....   | 64  |
| Gambar 3.8 Prosedur Penelitian tahap <i>Evaluate</i> (Evaluasi).....        | 65  |
| <br>  |     |
| Gambar 4.1 Tingkat Kesulitan Memahami Konsep <i>OSI Layer</i> .....         | 73  |
| Gambar 4.2 Tingkat Kesulitan Membedakan <i>OSI Layer</i> .....              | 74  |
| Gambar 4.3 Tingkat Kesulitan Mengingat Urutan <i>OSI Layer</i> .....        | 74  |
| Gambar 4.4 Tingkat Kesulitan Memahami Peran <i>OSI Layer</i> .....          | 75  |
| Gambar 4.5 Tingkat Kesulitan Menghubungkan Konsep <i>OSI Layer</i> .....    | 75  |
| Gambar 4.6 Tingkat Kesulitan Menemukan Sumber Belajar <i>OSI Layer</i> .... | 76  |
| Gambar 4.7 Proses Bisnis Media <i>Virtual Reality</i> .....                 | 84  |
| Gambar 4.8 Gambar Skala Interval Validasi Materi.....                       | 89  |
| Gambar 4.9 Proses Pengembangan VR di Unity.....                             | 97  |
| Gambar 4.10 Proses Pengembangan fitur <i>Quiz</i> dan Penilaian.....        | 98  |
| Gambar 4.11 Gambar Skala Interval Validasi Media.....                       | 106 |
| Gambar 4.12 Grafik Batang Rerata <i>Pretest &amp; Posttest</i> .....        | 111 |
| Gambar 4.13 Grafik Peningkatan CT.....                                      | 112 |
| Gambar 4.14 Hasil Analisis CTL terhadap CT.....                             | 113 |
| Gambar 4.15 Tahapan 1 CTL Pada Media.....                                   | 114 |
| Gambar 4.16 Tahapan 2 CTL Pada Media.....                                   | 115 |
| Gambar 4.17 Tahapan 3 CTL Pada Media.....                                   | 116 |
| Gambar 4.18 Skala Interval Tanggapan Siswa Terhadap Media.....              | 118 |
| Gambar 4.19 Korelasi Antar Aspek TAM.....                                   | 118 |

## DAFTAR LAMPIRAN

|  |     |
|--|-----|
| Lampiran 1. Hasil Wawancara Guru 1.....                      | 133 |
| Lampiran 2. Hasil Wawancara Guru 2.....                      | 135 |
| Lampiran 3. Angket Kuesioner Siswa.....                      | 139 |
| Lampiran 4. Modul Ajar Pertemuan 1.....                      | 142 |
| Lampiran 5. Modul Ajar Pertemuan 2.....                      | 149 |
| Lampiran 6. Lembar Judgement Instrumen Oleh Ahli Materi..... | 157 |
| Lampiran 7. Lembar Judgment Instrumen Oleh Ahli Media.....   | 161 |
| Lampiran 8. Lembar <i>Judgement</i> Instrumen Soal.....      | 163 |
| Lampiran 9. Hasil <i>Pretest</i> .....                       | 224 |
| Lampiran 10. Hasil <i>Posttest</i> .....                     | 226 |
| Lampiran 11. Uji Normalitas Kolmogorov-Smirnov.....          | 229 |
| Lampiran 12. Uji Paired T-test.....                          | 231 |
| Lampiran 13. Uji <i>N-Gain</i> .....                         | 232 |
| Lampiran 14. Uji <i>N-Gain</i> pada tiap komponen CT.....    | 233 |
| Lampiran 15. Kuesioner Siswa terkait Model CTL pada CT.....  | 234 |
| Lampiran 16. Hasil Tanggapan Siswa Terhadap Media.....       | 236 |
| Lampiran 17. Dokumentasi Penelitian.....                     | 238 |
| Lampiran 18. Surat Izin Penelitian Skripsi.....              | 239 |
| Lampiran 19. Surat Keterangan Selesai Penelitian.....        | 240 |

### DAFTAR PUSTAKA

- Agushinta, D., & Satria, A. (2018). Pembelajaran 3D sistem ekskresi manusia berbasis virtual reality dan android. *Jurnal Teknologi Informasi Dan Ilmu Komputer*. <https://www.academia.edu/download/68461445/pdf.pdf>
- Alqahtani, A. S., Daghestani, L. F., & ... (2017). Environments and system types of virtual reality technology in STEM: A survey. *International Journal of ...*. [https://www.academia.edu/download/54149683/Paper\\_10-Environments\\_and\\_System\\_Types\\_of\\_Virtual\\_Reality.pdf](https://www.academia.edu/download/54149683/Paper_10-Environments_and_System_Types_of_Virtual_Reality.pdf)
- Angeli, C., & Giannakos, M. (2020). Computational thinking education: Issues and challenges. *Computers in Human Behavior*. <https://www.sciencedirect.com/science/article/pii/S0747563219303978>
- Angeli, C., Voogt, J., Fluck, A., Webb, M., Cox, M., & ... (2016). A K-6 computational thinking curriculum framework: Implications for teacher knowledge. *Journal of Educational ...*. <https://www.jstor.org/stable/pdf/jeductechsoci.19.3.47.pdf>
- Anggriani, D. L. (2023). *ANALISIS KEMAMPUAN BERPIKIR KOMPUTASI DALAM MENYELESAIKAN SOAL HIGHER ORDER THINKING SKILL BERDASARKAN KEMAMPUAN ...*. [digilib.uinkhas.ac.id](http://digilib.uinkhas.ac.id). [http://digilib.uinkhas.ac.id/20138/1/DITA%20LOKA%20ANGGRIANI\\_T20197145.pdf](http://digilib.uinkhas.ac.id/20138/1/DITA%20LOKA%20ANGGRIANI_T20197145.pdf)
- Arikunto, S. (2021). *Dasar-dasar evaluasi pendidikan edisi 3*. [books.google.com](https://books.google.com). <https://books.google.com/books?hl=en&lr=&id=j5EmEAAAQBAJ&oi=fnd&pg=PA1&dq=arikunto&ots=6uDLChrJ1Q&sig=AlsV2SfW5jSfbbWnKXE7bJsbi58>
- Bailenson, J. N. (2008). The use of immersive virtual reality in the learning sciences: Digital transformations of teachers, students, and social context. *Journal of the Learning Sciences*, 17(1), 102–141. <https://doi.org/10.1080/10508400701793141>
- Bevevino, M. M., Dengel, J., & Adams, K. (1999). Constructivist theory in the classroom internalizing: Concepts through inquiry learning. *The Clearing House*. <https://doi.org/10.1080/00098659909599406>

- Billingsley, G., Smith, S., Smith, S., & ... (2019). A systematic literature review of using immersive virtual reality technology in teacher education. *Journal of Interactive ...* <https://www.learntechlib.org/p/176261/>
- Blanchard, A. (2001). Contextual teaching and learning. *Educational Services*.
- Bloom, B. S., Englehart, M. D., Furst, E. J., Hill, W. H., & ... (1956). *Taxonomy of educational objectives, handbook I: the cognitive domain*. New York: David McKay Co. Inc.
- Checa, D., & Bustillo, A. (2020). Advantages and limits of virtual reality in learning processes: Briviesca in the fifteenth century. *Virtual Reality*. <https://doi.org/10.1007/s10055-019-00389-7>
- Dale, P. (2000). *Contextual Teaching Work. Increasing Student Achievement Texas*. CCI Publishing.
- Duncan, C., Bell, T., & Atlas, J. (2017). What do the teachers think? Introducing computational thinking in the primary school curriculum. *Proceedings of the Nineteenth Australasian ...* <https://doi.org/10.1145/3013499.3013506>
- Elmqaddem, N. (2019). Augmented reality and virtual reality in education. Myth or reality? *International Journal of Emerging Technologies in ...* [https://www.researchgate.net/profile/Noureddine-Elmqaddem/publication/331110141\\_Augmented\\_Reality\\_and\\_Virtual\\_Reality\\_in\\_Education\\_Myth\\_or\\_Reality/links/62609115bca601538b5b56f4/Augmented-Reality-and-Virtual-Reality-in-Education-Myth-or-Reality.pdf](https://www.researchgate.net/profile/Noureddine-Elmqaddem/publication/331110141_Augmented_Reality_and_Virtual_Reality_in_Education_Myth_or_Reality/links/62609115bca601538b5b56f4/Augmented-Reality-and-Virtual-Reality-in-Education-Myth-or-Reality.pdf)
- Fakhriyah, F., Masfuah, S., & Roysa, M. (2017). The characteristics of scientific literacy-based teaching materials for developing computational thinking skills. *Proceeding of ICMSE*.
- Farsi, G. Al, Yusof, A. B. M., Fauzi, W. J. B., Rusli, M. E. B., & ... (2021). The practicality of virtual reality applications in education: Limitations and recommendations. *Journal of Hunan ...* <http://jonuns.com/index.php/journal/article/view/666>
- Farsi, G. Al, Yusof, A. M., Romli, A., & ... (2021). A Review of Virtual Reality Applications in an Educational Domain. ... *Journal of Interactive ...* [https://www.researchgate.net/profile/Ghaliya-Alfarsi/publication/356391992\\_A\\_Review\\_of\\_Virtual\\_Reality\\_Application](https://www.researchgate.net/profile/Ghaliya-Alfarsi/publication/356391992_A_Review_of_Virtual_Reality_Application)

s\_in\_an\_Educational\_Domai/links/634ac2e42752e45ef6bb09d8/A-Review-of-Virtual-Reality-Applications-in-an-Educational-Domai.pdf

- Fiteriani, I., & Solekha, I. (2016). Peningkatan hasil belajar IPA melalui model pembelajaran contextual teaching and learning (CTL) pada siswa kelas V MI raden intan wonodadi kecamatan .... .. *Pendidikan Dan Pembelajaran* .... <http://ejournal.radenintan.ac.id/index.php/terampil/article/view/1332>
- Gong, D. (2020). Exploring the key influencing factors on college students' computational thinking skills through flipped-classroom instruction. *International Journal of Educational Technology in Higher Education*, 17(1). <https://doi.org/10.1186/s41239-020-00196-0>
- Hamilton, D., McKechnie, J., Edgerton, E., & ... (2021). Immersive virtual reality as a pedagogical tool in education: a systematic literature review of quantitative learning outcomes and experimental design. *Journal of Computers in* .... <https://doi.org/10.1007/s40692-020-00169-2>
- Hasruddin, M. Y. N., & Rezeqi, S. (2015). Application of contextual learning to improve critical thinking ability of students in biology teaching and learning strategies class. *International Journal of Learning, Teaching* .... <https://citeseerx.ist.psu.edu/document?repid=rep1&type=pdf&doi=f12a2d6f4837691d3319a52bacdf317862f19ca5>
- Hudson, C. C., & Whisler, V. R. (2007). Contextual teaching and learning for practitioners. *Journal of Systemics, Cybernetics and Informatics*. <https://www.iiisci.org/journal/pdv/sci/pdfs/e668ps.Pdf>
- Hyun, C. C., Wijayanti, L. M., Asbari, M., & ... (2020). Implementation of contextual teaching and learning (CTL) to improve the concept and practice of love for faith-learning integration. ... *Journal of Control* .... [https://www.researchgate.net/profile/Choi-Chi-Hyun/publication/339874468\\_Implementation\\_of\\_Contextual\\_Teaching\\_and\\_Learning\\_CTL\\_to\\_Improve\\_the\\_Concept\\_and\\_Practice\\_of\\_Love\\_for\\_Faith-Learning\\_Integration/links/5e72391e92851c93e0ac16bc/Implementation-of-Contextual-Teaching-and-Learning-CTL-to-Improve-the-Concept-and-Practice-of-Love-for-Faith-Learning-Integration.pdf](https://www.researchgate.net/profile/Choi-Chi-Hyun/publication/339874468_Implementation_of_Contextual_Teaching_and_Learning_CTL_to_Improve_the_Concept_and_Practice_of_Love_for_Faith-Learning_Integration/links/5e72391e92851c93e0ac16bc/Implementation-of-Contextual-Teaching-and-Learning-CTL-to-Improve-the-Concept-and-Practice-of-Love-for-Faith-Learning-Integration.pdf)



- Jeka, F., Risnita, R., Jailani, M. S., & Asrulla, A. (2023). Kajian Literatur dalam Menyusun Referensi Kunci, State Of The Art, dan Keterbaharuan Penelitian (Novelty). *Jurnal Pendidikan Tambusai*.  
<https://www.jptam.org/index.php/jptam/article/view/10870>
- Jensen, L., & Konradsen, F. (2018). A review of the use of virtual reality head-mounted displays in education and training. *Education and Information Technologies*. <https://doi.org/10.1007/s10639-017-9676-0>
- Johnson, E. B. (2002). *Contextual teaching and learning: What it is and why it's here to stay*. books.google.com.  
[https://books.google.com/books?hl=en&lr=&id=2HRoigMMdqMC&oi=fnd&pg=PA9&dq=contextual+teaching+and+learning&ots=sWoQ\\_LBrIT&sig=v0XngvqxCOECUoct57mHYqhNdIE](https://books.google.com/books?hl=en&lr=&id=2HRoigMMdqMC&oi=fnd&pg=PA9&dq=contextual+teaching+and+learning&ots=sWoQ_LBrIT&sig=v0XngvqxCOECUoct57mHYqhNdIE)
- Kalelioğlu, F. (2018). Characteristics of studies conducted on computational thinking: A content analysis. *Computational Thinking in the STEM Disciplines ....* [https://doi.org/10.1007/978-3-319-93566-9\\_2](https://doi.org/10.1007/978-3-319-93566-9_2)
- Kartiko, I., Kavakli, M., & Cheng, K. (2010). Learning science in a virtual reality application: The impacts of animated-virtual actors' visual complexity. *Computers & Education*, 55, 881–891.  
<https://doi.org/10.1016/j.compedu.2010.03.019>
- King, D., Tee, S., Falconer, L., Angell, C., Holley, D., & ... (2018). Virtual health education: Scaling practice to transform student learning: Using virtual reality learning environments in healthcare education to bridge the theory/practice .... *Nurse Education* ....  
<https://www.sciencedirect.com/science/article/pii/S0260691718303782>
- Lin-Siegler, X., Dweck, C. S., & Cohen, G. L. (2016). Instructional interventions that motivate classroom learning. *Journal of Educational* ....  
<https://psycnet.apa.org/record/2016-15978-001>
- Lotulung, C. F., Ibrahim, N., & Tumurang, H. (2018). Effectiveness of Learning Method Contextual Teaching Learning (CTL) for Increasing Learning Outcomes of Entrepreneurship Education. *Turkish Online Journal of Educational* .... <https://eric.ed.gov/?id=EJ1184198>

- Makransky, G., Terkildsen, T. S., & Mayer, R. E. (2019). Adding immersive virtual reality to a science lab simulation causes more presence but less learning. *Learning and Instruction*.  
<https://www.sciencedirect.com/science/article/pii/S0959475217303274>
- Marangunić, N., & Granić, A. (2015). Technology acceptance model: a literature review from 1986 to 2013. *Universal Access in the Information Society*.  
<https://doi.org/10.1007/s10209-014-0348-1>
- Mujiani, D. (2016). Pengaruh media pembelajaran dan kecerdasan logis matematis terhadap hasil belajar matematika siswa. *Jurnal Pendidikan Dasar UNJ*.  
<https://core.ac.uk/download/pdf/297684593.pdf>
- Musril, H. A., Jasmienti, J., & ... (2020). Implementasi Teknologi Virtual Reality Pada Media Pembelajaran Perangkat Komputer. *Jurnal Nasional ....*  
<https://ejournal.undiksha.ac.id/index.php/janapati/article/view/23215>
- Natale, A. F. Di, Repetto, C., Riva, G., & ... (2020). Immersive virtual reality in K-12 and higher education: A 10-year systematic review of empirical research. *British Journal of ....* <https://doi.org/10.1111/bjet.13030>
- Panjaitan, D. J. (2018). Peningkatan Pemahaman dan Aplikasi Konsep Melalui Pendekatan Contextual Teaching and Learning. *Jurnal MathEducation Nusantara*. <http://jurnal.pascaumnaw.ac.id/index.php/JMN/article/view/8>
- Polcar, J., & Horejsi, P. (2013). Knowledge acquisition and cyber sickness: A comparison of VR devices in virtual tours. *Science*.  
[https://www.researchgate.net/profile/Jiri-Polcar/publication/279167289\\_Knowledge\\_acquisition\\_and\\_cyber\\_sickness\\_A\\_comparison\\_of\\_VR\\_devices\\_in\\_virtual\\_tours/links/59897291a6fdcc75626354f8/Knowledge-acquisition-and-cyber-sickness-A-comparison-of-VR-devices-in-virtual-tours.pdf](https://www.researchgate.net/profile/Jiri-Polcar/publication/279167289_Knowledge_acquisition_and_cyber_sickness_A_comparison_of_VR_devices_in_virtual_tours/links/59897291a6fdcc75626354f8/Knowledge-acquisition-and-cyber-sickness-A-comparison-of-VR-devices-in-virtual-tours.pdf)
- Radianti, J., Majchrzak, T. A., Fromm, J., & ... (2020). A systematic review of immersive virtual reality applications for higher education: Design elements, lessons learned, and research agenda. *Computers & Education*.  
<https://www.sciencedirect.com/science/article/pii/S0360131519303276>

- Ristiyani, E., & Bahriah, E. S. (2016). Analisis kesulitan belajar kimia siswa di SMAN X Kota Tangerang Selatan. *Jurnal Penelitian Dan Pembelajaran IPA*.  
<http://jurnal.untirta.ac.id/index.php/JPPI/article/view/431>
- Rosmansyah, Y., Putro, B. L., Putri, A., & ... (2022a). A simple model of smart learning environment. ... *Environments*.  
<https://doi.org/10.1080/10494820.2021.2020295>
- Rosmansyah, Y., Putro, B. L., Putri, A., & ... (2022b). A simple model of smart learning environment. *Interactive Learning* ....  
<https://doi.org/10.1080/10494820.2021.2020295>
- Rozie, F. (2018). Persepsi guru sekolah dasar tentang penggunaan media pembelajaran sebagai alat bantu pencapaian tujuan pembelajaran. *Widyagogik: Jurnal Pendidikan Dan Pembelajaran* ....  
<https://journal.trunojoyo.ac.id/widyagogik/article/view/3863>
- Schlechty, P. C. (2003). *Inventing better schools: An action plan for educational reform*. books.google.com.  
[https://books.google.com/books?hl=en&lr=&id=ATBoc5I8j\\_AC&oi=fnd&pg=PR9&dq=inventing+better+schools+an+action+plan+for+educational+reform&ots=xEMixP72Cc&sig=uNqq-D65CBhgYruUSCEwyqhH6pc](https://books.google.com/books?hl=en&lr=&id=ATBoc5I8j_AC&oi=fnd&pg=PR9&dq=inventing+better+schools+an+action+plan+for+educational+reform&ots=xEMixP72Cc&sig=uNqq-D65CBhgYruUSCEwyqhH6pc)
- Selby, C., & Woollard, J. (2013). *Computational thinking: the developing definition*. eprints.soton.ac.uk. <https://eprints.soton.ac.uk/356481>
- Simkus, J. (2022). Convenience sampling: Definition, method and examples. Retrieved Oktober. <https://www.simplypsychology.org/convenience-sampling.html>
- Sinaga, J. A. G. (2022). *ANALISIS KEMAMPUAN BERPIKIR KOMPUTASI (COMPUTATIONAL THINKING) SISWA SMA DALAM PEMECAHAN MASALAH*. digilib.unimed.ac.id. <http://digilib.unimed.ac.id/id/eprint/49541>
- Smith, S. S. F., & Lee, S. L. (2004). A pilot study for integrating virtual reality into an introductory design and graphics course. *Journal of Industrial Technology*.  
<https://www.iastatedigitalpress.com/jtmae/article/id/14249/>
- Sugiyono, D. (2013). *Metode penelitian pendidikan pendekatan kuantitatif, kualitatif dan R&D*. digilib.unigres.ac.id.  
[https://digilib.unigres.ac.id/index.php?p=show\\_detail&id=43](https://digilib.unigres.ac.id/index.php?p=show_detail&id=43)

- Sulistianingsih, A. S., & Kustono, D. (2022). Potensi Penggunaan Teknologi Augmented Reality (AR) dan Virtual Reality (VR) dalam Pembelajaran Sejarah Arsitektur di Era Pandemi Covid-19. *Jupiter (Jurnal Pendidikan ....* <http://e-journal.unipma.ac.id/index.php/JUPITER/article/view/12262>
- Supardi, S. U. S., Leonard, L., & ... (2015). Pengaruh media pembelajaran dan minat belajar terhadap hasil belajar fisika. *Formatif: Jurnal ....* <https://journal.lppmunindra.ac.id/index.php/Formatif/article/view/86>
- Tang, X., Yin, Y., Lin, Q., Hadad, R., & Zhai, X. (2020). Assessing computational thinking: A systematic review of empirical studies. *Computers & Education.* <https://www.sciencedirect.com/science/article/pii/S0360131519303483>
- Tikva, C., & Tambouris, E. (2021). Mapping computational thinking through programming in K-12 education: A conceptual model based on a systematic literature Review. *Computers & Education.* <https://www.sciencedirect.com/science/article/pii/S0360131520302815>
- Topali, P., & Mikropoulos, T. A. (2019). Digital learning objects for teaching computer programming in primary students. ... *and Innovation in Learning, Teaching and ....* [https://doi.org/10.1007/978-3-030-20954-4\\_19](https://doi.org/10.1007/978-3-030-20954-4_19)
- Wang, J. (2011). Virtual reality technology in the design of the space environment research. *2011 International Conference on Control, Automation ....* <https://ieeexplore.ieee.org/abstract/document/5997892/>
- Wing, J. (2006). Computational thinking. *Communications of the ACM*, 49(3), 33–35. <https://doi.org/10.1145/1118178.1118215>
- Zemelman, S., Daniels, H., & Hyde, A. A. (1998). Best practice: New standards for teaching and learning in America's schools. *(No Title).* <https://cir.nii.ac.jp/crid/1130282272358648960>
- Zhang, L. C., & Nouri, J. (2019). A systematic review of learning computational thinking through Scratch in K-9. *Computers & Education.* <https://www.sciencedirect.com/science/article/pii/S0360131519301605>