

Ardian Asyhari. 2025. Model Pembelajaran NEXUS Berbasis *Collaborative Cognitive Load Theory* dengan Pendekatan *Flipped Classroom* untuk Mengoptimalkan *Computational Thinking Skills* Mahasiswa. Disertasi. Promotor: Prof. Dr. Sunyono, M.Si. Kopromotor: Prof. Dr. Agus Suyatna, M.Si. Program Studi Doktor Pendidikan, Fakultas Keguruan dan Ilmu Pendidikan, Universitas Lampung.

ABSTRAK

Pendidikan tinggi di era digital menuntut mahasiswa memiliki keterampilan berpikir komputasional untuk menghadapi tantangan berbasis teknologi. Namun, pengembangan CTS sering terkendala oleh tingginya beban kognitif dan interaksi kolaboratif yang kurang optimal. Penelitian ini bertujuan mengembangkan dan menguji efektivitas model pembelajaran NEXUS yang mengintegrasikan *Collaborative Cognitive Load Theory* (CCLT) dengan pendekatan *Flipped Classroom* guna mengoptimalkan CTS mahasiswa pada mata kuliah Fisika Dasar. Metode penelitian yang digunakan adalah *Design and Development Research* dengan desain faktorial $2 \times 2 \times 2$, melibatkan variabel model pembelajaran (NEXUS dan ekspositori), keterampilan kolaborasi (tinggi dan rendah), serta beban kognitif (tinggi dan rendah). Analisis data dilakukan menggunakan ANOVA faktorial, uji lanjut Tukey HSD, serta regresi multivariat untuk mengidentifikasi pola interaksi antar variabel. Hasil validasi isi dan konstruk oleh pakar menunjukkan bahwa model NEXUS valid dengan nilai Aiken's V antara 0.90–0.93. Model ini juga dinilai sangat praktis (rata-rata skor 4.30–4.65 dari skala 5) oleh dosen dan mahasiswa. Secara empiris, hasil penelitian menunjukkan efektivitas signifikan model NEXUS dalam meningkatkan CTS mahasiswa ($F = 253.818$; $p < 0.001$; $\eta^2 = 0.920$) dengan dampak tertinggi pada kombinasi kolaborasi tinggi dan beban kognitif rendah ($M = 86.40$; $SD = 4.12$). Analisis regresi multivariat menunjukkan bahwa dimensi konsep, praktik, dan perspektif CTS memiliki sensitivitas berbeda terhadap beban kognitif dan kolaborasi, dengan pengaruh positif signifikan beban kognitif terhadap dimensi perspektif ($B = 0.101$; $p = 0.002$). Implikasi penelitian ini mencakup penguatan teori pembelajaran berbasis kolaborasi dan CCLT, implementasi praktis model NEXUS dalam berbagai mata kuliah STEM, serta rekomendasi kebijakan pengembangan kurikulum berbasis *Flipped Classroom* yang adaptif terhadap beban kognitif mahasiswa.

Kata Kunci: Model NEXUS, Collaborative Cognitive Load Theory, Flipped Classroom, Computational Thinking Skills, Manajemen Beban Kognitif.

Ardian Asyhari. 2025. *The NEXUS Learning Model Based on Collaborative Cognitive Load Theory with a Flipped Classroom Approach to Optimize Students' Computational Thinking Skills*. Promoter: Prof. Dr. Sunyono, M.Si. Co-Promoter: Prof. Dr. Agus Suyatna, M.Si. Doctoral Program in Education, Faculty of Teacher Training and Education, University of Lampung.

ABSTRACT

Higher education in the digital era demands students possess Computational Thinking Skills (CTS) to address technology-based challenges. However, the development of CTS is frequently hindered by high cognitive load and suboptimal collaborative interactions. This research aims to develop and evaluate the effectiveness of the NEXUS instructional model, integrating Collaborative Cognitive Load Theory (CCLT) with a Flipped Classroom approach to optimize students' CTS in Fundamental Physics courses. Employing the Design and Development Research method, this study utilized a factorial $2 \times 2 \times 2$ design involving instructional model variables (NEXUS and expository), collaboration skills (high and low), and cognitive load (high and low). Data analysis was conducted using factorial ANOVA, Tukey HSD post-hoc tests, and multivariate regression analysis to identify interaction patterns among variables. Expert validation results confirmed the content and construct validity of the NEXUS model, with Aiken's V values ranging from 0.90 to 0.93. The model was also assessed as highly practical by lecturers and students, achieving average practicality scores between 4.30 and 4.65 on a scale of 5. Empirically, the findings demonstrated significant effectiveness of the NEXUS model in enhancing students' CTS ($F = 253.818$; $p < 0.001$; $\eta^2 = 0.920$), with the highest impact occurring under conditions of high collaboration and low cognitive load ($M = 86.40$; $SD = 4.12$). Multivariate regression analysis indicated that the conceptual, practical, and perspective dimensions of CTS exhibited different sensitivities to cognitive load and collaboration, with cognitive load positively and significantly influencing the perspective dimension ($B = 0.101$; $p = 0.002$). The implications of this study encompass theoretical reinforcement of collaborative learning and CCLT, practical implementation of the NEXUS model in various STEM courses, and policy recommendations for developing adaptive, Flipped Classroom-based curricula attentive to students' cognitive load.

Keywords: NEXUS Model, Collaborative Cognitive Load Theory, Flipped Classroom, Computational Thinking Skills, Cognitive Load Management.