氏　　名	KHIN THET MON
授与した学位	博　士
専攻分野の名称	工　学
学位授与番号	博甲第　　７０５１　　号
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学位授与の要件	自然科学研究科　　産業創成工学専攻 （学位規則第４条第１項該当）
学位論文の題目	A Study of Grammar Concept Understanding and Value Trace Problems in JavaScript Programming Learning Assistant System （JavaScript プログラミング学習支援システムの文法概念理解および変数値トレース問題の研究）
論文審査委員	教授　舩曳信生　　教授　田野 哲　　教授　野上保之

学位論文内容の要旨

This thesis delves into the development of JSPLAS, aiming to create an educational tool that aligns with the evolving landscape of web development. The proposed structured approach in JSPLAS, from foundational grammar concept studies to advanced code writing exercises, mirrors best practices in programming education, providing structured and incremental learning experiences.

As the first contribution of this thesis, I focus on the Grammar-Concept Understanding Problem (GUP) as an introductory step in the exploration of web-client programming using JavaScript.

A GUP instance comprises a source code and a set of questions, each inquiring about the actual value of a crucial variable or an output message within the provided code. The assessment of correctness is achieved through string matching with predefined correct answers. GUP instances, integral to this study, comprise source codes and questions, with automated assessments ensuring prompt feedback to learners.

As the second contribution of this thesis, I present the value trace problems (VTP) for code reading study by novice students. I focus VTP as an integral component of the exploration into JavaScript programming education. A VTP instance comprises a source code and a set of questions, each inquiring about the actual value of a crucial variable or an output message within the provided code. The assessment of correctness is achieved through string matching with predefined correct answers. This study delves into the application of VTP for code reading in the context of JavaScript programming, shedding light on its efficacy as a pedagogical tool. I contribute to the ongoing efforts to enhance learning experiences in JavaScript programming by investigating and refining i methodologies for effective comprehension and skill development.

Based on these two contributions, as the third contribution of this thesis, I contribute the Grammar-Concept Understanding Problem (GUP) for learning the front-end programming using the Vue JS framework. This progressive JavaScript framework is approachable, performant, and versatile for building web user interfaces.

In subsequent phases of this research initiative, the generation of Grammar-Concept Understanding Problems (GUP) instances specific to JavaScript will be undertaken. These instances are designed to facilitate the in-depth study of advanced grammar concepts, prevalent libraries, and the intricacies of web application systems. Subsequently, these instances will be systematically allocated to students enrolled in JavaScript programming courses, thereby serving as a foundational tool for enhancing their comprehension and practical application of these concepts.

This thesis is organized as follows: Chapter 2 reviews the overview of the Java Programming Learning Assistant System (JPLAS) with the server platform, the software architecture, and the implemented problem types. Chapter 3 presents the Grammer-Concept Understanding Problems of JavaScript as the integration of JPLAS to JSPLAS. Chapter 4 presents the Value Trace Problem (VTP) methodology employed for self-study in JavaScript programming. Chapter 5 introduce the Grammar-Concept Understanding Problems (GUP) for Vue JS Framework in JSPLAS. Chapter 6 reviews the related works in literature. Finally, Chapter 7 concludes this thesis with some future works.

論文審査結果の要旨

In this thesis, the applicant presented the development of JavaScript Programming Learning Assistant System (JSPLAS), aiming to create an educational tool that aligns with the evolving landscape of web development.

As the first contribution, the applicant focused on the Grammar-Concept Understanding Problem (GUP) as an introductory step in the exploration of web-client programming using JavaScript. A GUP instance comprises a source code and a set of questions, each inquiring about the actual value of a crucial the definition of a crucial word within the provided code. The assessment of correctness is achieved through string matching with predefined correct answers. GUP instances comprise source codes and questions, with automated assessments ensuring prompt feedback to learners.

As the second contribution, the applicant presented the value trace problems (VTP) for code reading study by novice students. A VTP instance comprises a source code and a set of questions, each inquiring about the actual value of a crucial variable or an output message within the provided code. The assessment of correctness is achieved through string matching. She investigated and refined methodologies for effective comprehension and skill development.

Based on the two contributions, as the third contribution, the applicant contributed the Grammar-Concept Understanding Problem (GUP) for learning the front-end programming using the Vue JS framework. This progressive JavaScript framework is approachable, performant, and versatile for building web user interfaces.

The applicant has published one journal paper and two international conference papers to present the contributions.

From the overall evaluation of this thesis, the applicant has satisfied the qualification condition for the doctor degree in Engineering from the Graduate School of Natural Science and Technology at Okayama University.