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Development of a Blended Learning Model Assisted by Google Classroom to Enhance Learning Independence and Achievement in the Computer Applications Course

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Abstract: Computer application courses today require a timely innovation with the integration of online and offline learning. This study aimed at developing a blended learning model assisted by the Google Classroom (BLMAGC) to enhance students' independent learning and academic achievement in computer application courses. This study adopted the Dick and Carey's (2014) model of research and development. With this model, the development of BLMAGC was oriented towards the use of constructivist, behaviorist, connectivist, and cognitivist theories. The prototype of model was validated by experts through Delphi techniques, and revisions were made based on their feedback. The prototype was further tested in ways of limited and extensive testing through the design of experimentation. Limited testing involved 15 randomly selected students from the Educational Management Program. Learning occurred over six sessions, with odd-numbered sessions conducted online and even-numbered sessions conducted in a face-to-face mode. Pretests and posttests were administered to measure learning achievement. Extensive testing involved two groups of students: an experimental group and a control group. Students from the MPI, PAI, and TBI programs made up the experimental group, while students from the TBIN, PBA, and PGMI programs comprised the control group. Each class consisted of 15 students. The data were collected using interviews, questionnaires, and tests and analyzed in qualitative and quantitative ways. The results revealed that BLMAGC, after getting validated by the experts and tested, was effective in improving students' independent learning and academic achievement in computer application courses. Further studies are expected to develop other models for the advancement of computer application courses.

Keywords: blended learning; google classroom; independent learning; learning achievement; computer application

Abstrak: *Mata kuliah aplikasi komputer saat ini membutuhkan inovasi tepat waktu dengan integrasi pembelajaran daring dan luring. Penelitian ini bertujuan untuk mengembangkan model pembelajaran gabungan yang dibantu oleh Google Classroom (BLMAGC) untuk meningkatkan pembelajaran mandiri dan prestasi akademis mahasiswa dalam mata kuliah aplikasi komputer. Penelitian ini mengadopsi model penelitian dan pengembangan Dick and Carey (2014). Dalam model ini, pengembangan BLMAGC diarahkan pada penggunaan teori konstruktivis, behavioris, konektivis, dan kognitivis. Prototipe model divalidasi oleh para ahli melalui teknik Delphi, dan revisi dilakukan berdasarkan masukan mereka. Prototipe selanjutnya diuji dengan*

metode pengujian terbatas dan ekstensif melalui desain eksperimen. Pengujian terbatas melibatkan 15 mahasiswa yang dipilih secara acak dari Program Manajemen Pendidikan. Pembelajaran berlangsung selama enam sesi, dengan sesi bernomor ganjil dilakukan secara daring dan sesi bernomor genap dilakukan secara tatap muka. Pretes dan postes diadminisrasi untuk mengukur pencapaian pembelajaran. Pengujian ekstensif melibatkan dua kelompok mahasiswa: kelompok eksperimen dan kelompok kontrol. Mahasiswa dari program MPI, PAI, dan TBI membentuk kelompok eksperimen, sementara mahasiswa dari program TBIN, PBA, dan PGMI membentuk kelompok kontrol. Setiap kelas terdiri dari 15 mahasiswa. Data dikumpulkan melalui wawancara, kuesioner, dan tes, serta dianalisis secara kualitatif dan kuantitatif. Hasil penelitian menunjukkan bahwa BLMAGC, setelah divalidasi oleh para ahli dan diuji, efektif dalam meningkatkan pembelajaran mandiri dan prestasi akademis mahasiswa dalam mata kuliah aplikasi komputer. Penelitian lebih lanjut diharapkan dapat mengembangkan model lain untuk kemajuan mata kuliah aplikasi komputer.

Kata Kunci: Pembelajaran Gabungan; Google Classroom; Pembelajaran Mandiri; Prestasi Belajar; Aplikasi Komputer

INTRODUCTION

Independent or self-directed learning is crucial in computer application courses because computer technology continues to evolve, requiring students to have the ability to continually learn and stay updated to succeed in this field. Self-directed learning is an individual's capacity to organize, manage, and motivate oneself in the learning process without relying on external assistance, thereby achieving learning objectives effectively.[1] It involves taking initiative in information retrieval, problem-solving, and self-driven understanding. In computer application courses, face-to-face instruction is typically employed because learning is practical and computer oriented.[2] However, face-to-face learning in computer application courses has some drawbacks that can hinder students' self-directed learning. In face-to-face learning, students tend to depend on instructors for direct teaching, which can reduce their motivation to seek independent understanding. Students often become overly reliant on instructors to explain concepts and solve problems, thus stifling their self-driven learning initiative. Face-to-face learning often has tight time constraints in teaching various topics. Due to these time limitations, instructors may not be able to explain every detail or provide adequate support to every student, especially in

[1] Meina Zhu, Curtis J. Bonk, and Min Young Doo, "Self-Directed Learning in MOOCs: Exploring the Relationships among Motivation, Self-Monitoring, and Self-Management," *Educational Technology Research and Development* 68, no. 5 (October 2020): 2073–93, https://doi.org/10.1007/s11423-020-09747-8.

[2] Yong He and Yizhi Li, "Research on Teaching Method of Computer Application Course Based on Evidence-Based Teaching Method," in *Journal of Physics: Conference Series*, vol. 1648 (IOP Publishing, 2020), 032182, https://iopscience.iop.org/article/10.1088/1742-6596/1648/3/032182/meta.

large classes.[3] This can impede students' abilities to gain deep understanding or overcome difficulties independently.

On the other hand, since the onset of Covid-19, the transformation of learning to online mode has also been implemented in computer application courses. However, online learning alone also has drawbacks that can hinder students' learning control in computer application courses. One of the main disadvantages is the lack of direct interaction with instructors and classmates. This limited interaction can impede students' abilities to ask direct questions, engage in discussions, or receive immediate feedback from instructors, which may be essential for better understanding.[4] Online learning of this kind often requires a high level of discipline from students in managing their time and following their own learning schedules. Students must be capable of self-management without direct supervision, which can be a challenge for individuals with poor time management skills. Ideally, self-directed learning should be controlled.

To address the aforementioned weaknesses and facilitate students' self-directed learning in computer application courses, lecturers need to consider an approach that combines elements of face-to-face and online learning. Thus, students can leverage the advantages of both learning methods to enhance their understanding of computer applications and develop effective self-directed learning. To benefit from both online and face-to-face methods while avoiding their respective drawbacks, one ideal strategy is to develop a blended learning model for computer application courses. Blended learning is an instructional approach that combines two main elements, face-to-face and online learning, within a curriculum or program.[5] This approach combines direct interaction between instructors and students with the use of digital technology and online resources. Blended learning aims to optimize the strengths of both learning methods, creating a more flexible, diverse, and adaptive learning experience.[6]

Face-to-face learning in blended learning is often utilized to facilitate group discussions, practical activities, or experiments that require physical

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[3] Jitendra Singh, Keely Steele, and Lovely Singh, "Combining the Best of Online and Face-to-Face Learning: Hybrid and Blended Learning Approach for COVID-19, Post Vaccine, & Post-Pandemic World," *Journal of Educational Technology Systems* 50, no. 2 (2021): 140–71.

[4] Singh, Steele, and Singh.

[5] Karen Smith and John Hill, "Defining the Nature of Blended Learning through Its Depiction in Current Research," *Higher Education Research & Development* 38, no. 2 (February 23, 2019): 383–97, https://doi.org/10.1080/07294360.2018.1517732.

[6] Rasheed Abubakar Rasheed, Amirrudin Kamsin, and Nor Aniza Abdullah, "Challenges in the Online Component of Blended Learning: A Systematic Review," *Computers & Education* 144 (2020): 103701.

presence. On the other hand, online learning is employed to deliver instructional materials, assignments, and additional resources online, granting students flexibility in accessing learning content anytime and anywhere.[7] The concept of blended learning acknowledges that each method of learning has its own strengths and weaknesses. By combining them, this approach creates a more customized learning experience that can be accessed by students with various learning styles. Therefore, blended learning has become a popular approach in higher education and professional training to enhance the quality of learning and students' self-directed learning.

In the aspect of online learning within the blended learning model, one contributory tool is the Google Classroom application. The primary advantage of the Google Classroom application lies in its ease of access to learning materials, which can be quickly and efficiently accessed by students.[8] Additionally, Google Classroom facilitates interaction and collaboration between students and instructors through discussion forums and integration with learning tools, such as Google Docs. This enables in-depth conceptual discussions and collaboration in project development. Automated assessment features enable efficient evaluation, while data on learning progress provide valuable insights for more targeted guidance. Through the use of Google Classroom, students can control their learning process, adjust schedules, and explore additional materials as needed.[9] Furthermore, this platform also provides learning activity data that can be used for deeper analysis and robust technical support for instructors and students alike.

Previous research has been conducted in the field of computer application courses. Research conducted by Nasution[10] aimed to develop the Digital Pocketbook Android Application for Introduction to Computer Application and evaluate its suitability by subject matter experts, media experts, and students. The results indicated a high level of validity by subject matter experts, excellence as perceived by media experts, and positive feedback from

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[7] Bin Yin and Chih-Hung Yuan, "Blended Learning Performance Influence Mechanism Based on Community of Inquiry," *Asia Pacific Journal of Education*, April 10, 2022, 1–16, https://doi.org/10.1080/02188791.2022.2061912.

[8] Malin Ideland, "Google and the End of the Teacher? How a Figuration of the Teacher Is Produced through an Ed-Tech Discourse," *Learning, Media and Technology* 46, no. 1 (January 2, 2021): 33–46, https://doi.org/10.1080/17439884.2020.1809452.

[9] Benjamin Gleason and Marie K. Heath, "Injustice Embedded in Google Classroom and Google Meet: A Techno-Ethical Audit of Remote Educational Technologies," *Italian Journal of Educational Technology* 29, no. 2 (2021): 26–41.

[10] Hanifah Nur Nasution and Sari Wahyuni Rozi Nasution, "Pengembangan Media Pembelajaran Berbasis Android Matakuliah Aplikasi Komputer Guna Meningkatkan Minat Belajar Mahasiswa," *Jurnal Education and Development* 5, no. 1 (2018): 8–8.

students, rendering it suitable for use as a learning tool to enhance the quality of education in the Informatics Vocational Department. Research by Rizal and Walidain[11] assessed the suitability of an e-learning application based on Moodle for the subject of Introduction to Computer Application for PGSD students at FKIP, Universitas Serambi Mekkah. Despite issues related to slow access, content, design, and technical aspects, the application was found to be suitable for use, contributing to an improved learning experience for students. Suryani and Irmayanti's research[12] aimed to develop a valid, practical, and effective Android-based e-learning module for the Computer Application subject at Universitas Muhammadiyah Sumatera Barat. The research results showed that the module was valid (88%) and practical (97.3%) based on feedback from instructors and effective, with a student pass rate of 91%. The implication is that this module can assist students in self-directed learning for distance education. Furthermore, Saputra and Purnama[13] developed an interactive computer-based learning media for Computer Organization to enhance students' interest and understanding. This media was found to enhance student motivation and comprehension, enabling self-directed learning, and enriching their learning experiences.

The previous research presented above has contributed to our understanding of the essence and benefits of conducting development research. However, research on the development of a blended learning model for computer application courses is still relatively scarce. Based on the research gap outlined earlier, this study is conducted to develop a Blended Learning Model Assisted by the Google Classroom (BLMAGC) to enhance students' self-directed learning and academic achievement in computer application courses.

To orient this study clearly, the study problems are formulated as could be seen in the following research questions: first, what is the appropriate model of blended learning to enhance students' independent learning in computer

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[11] Syamsul Rizal and Birrul Walidain, "Pembuatan Media Pembelajaran E-Learning Berbasis Moodle Pada Matakuliah Pengantar Aplikasi Komputer Universitas Serambi Mekkah," *JURNAL ILMIAH DIDAKTIKA: Media Ilmiah Pendidikan Dan Pengajaran* 19, no. 2 (2019): 178–92.

[12] Hamidah Suryani and Irmayanti Irmayanti, "Pengembangan Media Pembelajaran Berbasis Komputer Pada Mata Kuliah Aplikasi Komputer Terapan Tata Busana," in *Prosiding Seminar Nasional LP2M UNM. Retrieved from Https://Ojs. Unm. Ac. Id/Semnaslemlit/Article/View/8553*, 2019, https://garuda.kemdikbud.go.id/documents/detail/3552478.

[13] Wawan Saputra and Bambang Eka Purnama, "Pengembangan Multimedia Pembelajaran Interaktif Untuk Mata Kuliah Organisasi Komputer," *Speed-Sentra Penelitian Engineering Dan Edukasi* 4, no. 2 (2015), http://ijns.org/journal/index.php/speed/article/view/865.

application practice? Second, what is the appropriate model of blended learning to improve students' academic performance? Third, how is the design of an effective model of blended learning that can enhance students' independent learning in computer application practice? Fourth, how is the form of an effective model of blended learning that can improve students' academic performance in computer application practice?"

In order to map theoretical information about various components related to a blended learning model assisted by Google Classroom to enhance learning independence and achievement in the computer applications course, theoretical components in respect of learning model, blended learning, Google Classroom, learning independence, learning achievement, and computer application course are presented below.

The first theoretical component is learning model. A learning model refers to the conceptual framework that forms the basis for designing and managing the learning process.[14] It encompasses learning objectives that define the desired outcomes, teaching strategies that provide guidance on content delivery, learning methods that involve concrete teaching techniques, learning resources that support the learning process, and assessments used to measure goal attainment. Additionally, the concept of a learning model also considers contextual factors such as culture, technology, and learner characteristics.[15] Learning models can be adapted to various situations, subjects, and educational levels, making them a powerful tool in creating effective and relevant learning experiences for learners.[16] Educators must be wise in selecting and designing learning models that best fit their learning needs and objectives.

Joyce explained that learning models have several distinctive features, including being grounded in educational theory, having educational goals, serving as guides, consisting of multiple components such as syntax, response principles, social systems, and support systems, having instructional impact, and requiring instructional design by teachers.[17] Syntax in learning models refers to

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[14] Tamara Galoyan and Kristen Betts, "Integrative Transfer of Learning Model and Implications for Higher Education," *The Journal of Continuing Higher Education* 69, no. 3 (September 2, 2021): 169–91, https://doi.org/10.1080/07377363.2020.1847970.

[15] Lin Luan et al., "Exploring the Role of Online EFL Learners' Perceived Social Support in Their Learning Engagement: A Structural Equation Model," *Interactive Learning Environments* 31, no. 3 (April 3, 2023): 1703–14, https://doi.org/10.1080/10494820.2020.1855211.

[16] Femi Emmanuel Ayo et al., "Network Intrusion Detection Based on Deep Learning Model Optimized with Rule-Based Hybrid Feature Selection," *Information Security Journal: A Global Perspective* 29, no. 6 (November 1, 2020): 267–83, https://doi.org/10.1080/19393555.2020.1767240.

[17] Bruce R. Joyce, Marsha Weil, and Emily Calhoun, *Models of Teaching*, 9th ed. (Pearson, 2014), http://gen.lib.rus.ec/book/index.php?md5=504020fbb8932e45aff8b29505e43ff0.

the sequence of steps in their use. Response principles encompass student behaviors in interaction with the learning model, such as responses to questions and rules in the learning process. Social systems refer to the roles of interaction between teachers and students in creating learning situations. Support systems include facilities that support the learning process. Instructional impact is the expected outcome of implementing the learning model, while ancillary effects are additional effects that may occur. In this study, a Google Classroom-based blended learning model was designed with two learning phases: online/offline asynchronous and synchronous face-to-face. Response principles and support systems were applied in the development of this model to achieve student self-directed learning and enhance learning achievement in the computer application course.

The second theoretical component is blended learning. Blended learning is an instructional approach that combines elements of online learning with face-to-face learning within an integrated learning experience.[18] It leverages technology to deliver instructional content online, often through electronic learning platforms, while also maintaining direct interaction between learners and instructors during in-person sessions. The concept of blended learning is designed to harness the advantages of both types of learning, enhancing flexibility, accessibility, and learning effectiveness.[19] It enables learners to manage their learning time and location according to their individual needs.

The third theoretical component is Google Classroom. Google Classroom is an online learning platform developed by Google. It enables instructors to create virtual classroom spaces where they can manage instructional materials, assignments, and interactions with students.[20] The platform leverages the advantages of Google technologies such as Google Drive, Gmail, and Google Calendar to create an integrated and user-friendly learning environment for both instructors and students. In the context of blended learning, Google Classroom facilitates a seamless integration between online and face-to-face learning. Instructors can deliver instructional materials, assignments, and resources online, while in-person sessions are used for discussions, practical exercises, or other interactive learning activities.[21] The

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[18] Yin and Yuan, "Blended Learning Performance Influence Mechanism Based on Community of Inquiry."

[19] Rasheed, Kamsin, and Abdullah, "Challenges in the Online Component of Blended Learning."

[20] Adit Gupta and Pooja Pathania, "To Study the Impact of Google Classroom as a Platform of Learning and Collaboration at the Teacher Education Level," *Education and Information Technologies* 26, no. 1 (2021): 843–57.

[21] Gleason and Heath, "Injustice Embedded in Google Classroom and Google Meet."

platform allows students to access materials at any time, submit assignments, and collaborate in a well-organized environment. Thus, Google Classroom becomes a powerful tool for implementing an efficient and effective blended learning model in computer application courses.

The fourth theoretical component is learning independence. Students' independent or self-directed learning is the ability and motivation of students to take initiative in managing and organizing their own learning.[22] Indicators of student self-directed learning encompass several key aspects. First, students can set specific and clear learning goals in line with expectations. Second, they can efficiently manage their time, including creating study schedules and adhering to deadlines. Third, students show initiative in taking initial steps in learning without constant guidance from instructors. Fourth, they can seek and gather information from various relevant sources. Fifth, they understand and can apply concepts or learning materials effectively. Sixth, students have good self-awareness regarding their learning progress, including the abilities to evaluate their strengths and weaknesses. Seventh, they are driven by intrinsic motivation to learn, meaning they have internal motivation without depending on external rewards or instructor supervision. Eighth, they actively engage in learning, such as discussing, asking questions, or participating in projects. Finally, they are aware of their personal responsibility in achieving learning goals.[23] These indicators collectively reflect the extent to which students can independently manage and advance their learning.

Self-directed learning in the context of computer application courses refers to students' ability to take initiative in understanding, mastering, and applying computer concepts independently. This includes the ability to explore software, solve problems, seek additional online resources, and overcome technical challenges without direct assistance from instructors. In computer application courses, self-directed learning becomes key in mastering various tools and techniques required to develop skills relevant to the field. Students need to have high intrinsic motivation, self-discipline, and metacognitive abilities

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[22] Shuang Geng, Kris MY Law, and Ben Niu, "Investigating Self-Directed Learning and Technology Readiness in Blending Learning Environment," *International Journal of Educational Technology in Higher Education* 16, no. 1 (2019): 1–22.

[23] Deddy Lasfeto, "The Relationship between Self-Directed Learning and Students' Social Interaction in Online Learning Environment," *Journal of E-Learning and Knowledge Society* 16, no. 2 (2020): 34–41; Laura Scheel, Gergana Vladova, and André Ullrich, "The Influence of Digital Competences, Self-Organization, and Independent Learning Abilities on Students' Acceptance of Digital Learning," *International Journal of Educational Technology in Higher Education* 19, no. 1 (2022): 1–33; Patti Wojahn et al., "Increasing Metacognitive Awareness through Reflective Writing: Optimizing Learning in Engineering," in *ASSE'S Virtual Conference*, 2020, 1–11.

to achieve effective self-directed learning in understanding and mastering computer applications.

The fifth theoretical component is learning achievement. Learning achievement refers to the level of an individual's accomplishment or success in understanding and mastering learning materials.[24] Learning achievement in the context of computer application courses encompasses how well a student succeeds in comprehending, mastering, and applying concepts and skills related to software usage and computer technology. Indicators of learning achievement in this course can be observed through exam or assignment results, a student's ability to develop computer programs or applications, as well as their creativity in solving computer-related problems. Factors that shape learning achievement in computer application courses include motivation, self-directed exploration and technical problem-solving, time management skills for complex projects, and access to additional resources such as online tutorials, literature, or instructor support.[25] The quality of teaching, including the use of effective and relevant teaching methods, also influences learning achievement. In computer application courses, good learning achievement reflects a deep understanding of computer concepts, the ability to design and develop functional applications, and the capacity to overcome technical challenges that may arise. Success in this course often impacts a student's ability to integrate computer knowledge in future work or projects.

The sixth theoretical component is computer application. Computer application practice refers to the utilization of software applications designed to perform specific functions on a computer.[26] Computer application courses at the undergraduate level generally cover the introduction and utilization of computer software applications within a professional or business context. These courses are typically included in the curriculum of related departments or majors such as Computer Science, Information Systems, or Information Management. They typically delve into topics such as the introduction and utilization of office applications (e.g., Microsoft Office), graphics applications (e.g., Adobe Photoshop or CorelDRAW), database applications (e.g., MySQL or Microsoft Access), as well as web applications (e.g., HTML, CSS, and JavaScript). Moreover, undergraduate computer application courses may also address the

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[24] Hamzeh Haghighi et al., "Impact of Flipped Classroom on EFL Learners' Appropriate Use of Refusal: Achievement, Participation, Perception," *Computer Assisted Language Learning* 32, no. 3 (2019): 261–93.

[25] He and Li, "Research on Teaching Method of Computer Application Course Based on Evidence-Based Teaching Method."

[26] Inés Sittón-Candanedo et al., "A Review of Edge Computing Reference Architectures and a New Global Edge Proposal," *Future Generation Computer Systems* 99 (2019): 278–94.

ethics and security of computer application usage, integration between different applications, the development of simple applications, and the utilization of applications to enhance productivity and efficiency in business or organizations. In these courses, students learn to use computer applications through both theory and hands-on laboratory sessions. These practical sessions are usually conducted in computer laboratories and involve direct and practical use of applications, enabling students to develop technical skills and creativity in utilizing computer applications.

METHOD

This study used a research and development (R&D) method to develop a blended learning model assisted by Google Classroom to enhance learning independence and achievement in the computer applications course. This R&D method adopted the Dick and Carey's version.[27] The reason of adopting this version is because it comprises a systematic approach in designing, developing, and evaluating an instructional model. This version emphasizes clear steps in analysis, design, development, implementation, and evaluation, thereby ensuring the effectiveness and success of the developed instructional model.

This R&D research aimed at addressing issues in practical computer application learning by developing a learning product. The development of a blended learning model in this course aimed to shift the instructional approach from Teacher-Centered Learning to Student-Centered Learning, enabling learners to discover teaching materials independently and actively during the learning process, without relying on instructors. The blended learning model combined online and face-to-face learning without sacrificing the interaction between students, instructors, and the course materials. This research focused on structuring the blended learning model for practical computer application in higher education, encompassing the interactions among its components.

Procedure of Development

The research procedure in the development of a blended learning model is of paramount significance as it primarily focuses on the creation of a product to be utilized in practical laboratory instruction. Throughout the developmental phase, scientific testing was conducted to validate its impact on users, specifically students and instructors. This research followed the Research and

[27] Walter Dick, Lou Carey, and James O. Carey, *The Systematic Design of Instruction*, 8th ed. (Pearson, 2015), http://gen.lib.rus.ec/book/index.php?md5=d85e01b5168b8fc308048c94cd980549.

Development (R&D) paradigm,[28] comprising ten stages, which encompassed the identification of learning objectives, instructional analysis, learner characteristics and learning context analysis, formulation of specific learning goals, development of assessment instruments, learning strategies, instructional materials, formative evaluation, program revision, and summative evaluation. A preliminary study entailed a comprehensive review of relevant literature, observations, and interviews with instructors who taught the computer application practical course. Subsequently, competencies expected and learning outcomes for each topic were identified, along with the identification of information technology infrastructure. The initial product developed encompassed a hypothetical learning model, a semester-based lesson plan, laboratory modules, laboratory guides, online learning guides, and evaluation tools. This product was then subjected to validation by experts through Delphi techniques, and revisions were made based on their feedback. Following this, the hypothetical learning model was piloted initially with a limited number of subjects, and later with a broader subject base across multiple higher education institutions. The trial results were employed to further refine the product. Once the product was deemed valid, it was subsequently implemented and disseminated to user institutions and instructors conducting computer application laboratory courses.

Product Trial and Samples

Testing in product development is a crucial stage that encompasses both formative and effectiveness testing of the learning model. The testing phase consisted of two steps: limited testing and extensive testing. Each step involved activities such as syntax testing, observation of student and instructor responses, and assessment of instructional materials. Limited testing involved 15 randomly selected students from the Educational Management Program. Over three sessions, evaluations were carried out on the lesson plan, instructional materials, strategies, methods, and instructional media. At this stage, the concept map-based blended learning model was tested to enhance student self-directed learning and performance. Learning occurred over six sessions, with odd-numbered sessions conducted online and even-numbered sessions conducted in a face-to-face mode. Pretests and posttests were administered to measure learning achievement.

The instructional content covered word processing applications, data processing, presentation applications, project management, and photo editing.

[28] Walter Dick, Lou Carey, and James O. Carey, *The Systematic Design of Instruction*, 8th ed. (Pearson, 2015), http://gen.lib.rus.ec/book/index.php?md5=d85e01b5168b8fc308048c94cd980549.

Extensive testing involved two groups of students: an experimental group and a control group. Using an experimental method and a pretest-posttest control group design, students from six academic programs were involved. Students from the MPI, PAI, and TBI programs made up the experimental group, while students from the TBIN, PBA, and PGMI programs comprised the control group. Each class consisted of 15 students. The experimental group employed BLMAGC, whereas the control group used a conventional learning method.

Techniques of Data Collection

The data required for this research was divided into three categories: data obtained from expert test analysis related to the feasibility of the developed product, data related to the analysis of learning impacts such as self-directed learning and learning achievement, and data related to subjects' perceptions of the developed learning model, from either an instructional product or interface aspect. Data collection techniques used included the use of questionnaires to gather information about student characteristics, student learning environments, student learning challenges, student needs, and to measure students' learning independence in the computer application course. In addition, semi-structured interviews with informants were conducted to obtain qualitative data that complemented the quantitative data obtained through questionnaires, with a focus on student characteristics, student learning environments, student learning challenges, and student needs. A documentation technique was used to collect data from various documents such as course syllabi, lesson plans, semester learning plans (RPS), and computer application practical course modules/textbooks. Lastly, performance tests were used to measure student learning achievements in the computer application practical course after implementing the blended learning model. All these data collection techniques were integral parts of this research to support the development of the blended learning model.

Techniques of Data Analysis

In this research, two data analysis techniques were employed, namely quantitative and qualitative data analyses, with a focus on the evaluation of BLMAGC. Quantitative data analysis involved the use of descriptive analysis techniques to measure student needs, self-directed learning, and learning achievement using a 4-point Likert scale. The research questionnaire was considered of high quality if its validity and reliability were pursued. Furthermore, qualitative data analysis was used to confirm the quantitative need analysis data, utilizing an interactive model encompassing data collection, reduction, presentation, and interview data inference. Qualitative data served as confirmatory materials for quantitative data.

Product validity analysis was conducted through a Delphi test using a questionnaire with scores ranging from 1 to 4. These scores were interpreted from "inappropriate/unsuitable/incomplete/poor" to "highly appropriate/highly suitable/highly complete/highly satisfactory." Product feasibility criteria based on percentages were applied after the validity test. The impacts of BLMAGC on students' learning independence and achievement were tested using a t-test. The t-test examined the differences and effectiveness of BLMAGC, as reviewed from pretest and posttest data. Subject perceptions regarding the instructional aspects and product interface were evaluated through descriptive analysis using percentages, with a rating scale ranging from "strongly disagree" to "strongly agree." The determination of perception levels was made by calculating percentages based on the number of choices provided by the respondents for each rating scale. Product feasibility criteria were also applied based on the percentages of research subject responses.

RESULTS

Results of Preliminary Study (Stages 1 – 4)

Identification of Objectives

The initial identification phase in the development of the blended learning model assisted by Google Classroom to enhance students' learning independence achievement in the computer application course was a crucial first step. The process of formulating objectives began with the identification of the fundamental competencies that students needed to master. From this point, learning objectives were defined, encompassing cognitive, affective, and psychomotor aspects. The learning objectives for the computer application course to be achieved through the Blended Learning model with Google Classroom included explaining the use of computer applications in daily life and business, operating various productivity applications, using creative applications, applying design principles, and analyzing problems for resolution.

Conducting Instructional Analysis

Instructional analysis was conducted through several phases, which involved identifying students' knowledge and skills, determining the learning structure, and deciding on teaching strategies. In relation to the identification of necessary knowledge and skills, the research findings revealed that students needed to develop several critical skills, including digital literacy, analytical thinking, creative thinking, time management, effective communication, collaboration, and problem-solving. With these skills, they would be better prepared to face the competitive job market and evolving technology.

Regarding the determination of the learning structure, the blended learning model assisted by the Google Classroom application for the computer application course was based on four learning theories: constructivism, behaviorism, cognitivism, and connectivism. The learning structure developed can be seen in Table 1.

Table 1. Learning Structure

The blended learning model assisted by the Google Classroom application for the computer application course aims to provide a more effective and efficient learning experience for students. This model is grounded in four learning theories: constructivism, behaviorism, cognitivism, and connectivism.
Online Learning Phase for One Meeting
The first phase of this model involves knowledge construction, which is based on constructivist theory. In this stage, students are required to read relevant reference materials provided and consider how these concepts relate to their prior knowledge. The aim is to construct new knowledge through reflection on previous experiences and information. Students are also asked to participate in online discussions to address the material and exchange opinions with fellow students. The second phase of this model is modeling, based on behaviorist theory. In this stage, students are presented with case examples and real-life case studies on how the concepts they have learned can be applied. Students are expected to follow these examples and take part in related discussions and activities. The goal is to help students deepen their understanding of the learned concepts and illustrate how these concepts can be applied in real-life situations. In practice, the first and second phases are conducted online through the Google Classroom application in a single session. Students are granted access to reference materials, case examples, and case studies through this platform. Discussions and related activities take place through online discussion forums and assignments. In addition, instructors provide feedback on student participation and performance through comments and assessments using the Google Classroom platform.
Face-to-face Learning Phase for One Meeting
The third phase of the blended learning model involves collaborative learning and practical application, drawing from constructivist and connectivist theories. In this phase, students interact with their environment and peers to

construct knowledge. Students are required to work in small groups and collaborate in learning and practicing the material together. They share ideas, experiences, and understandings with their group members and collaborate to complete assignments and projects.

The fourth phase of this model is individual learning and application, based on cognitive theory. In this phase, students are given individual tasks that involve independent information processing and decision-making. Students are asked to identify problems and solutions and make decisions based on their understanding of the material.

The fifth phase in the blended learning model is a consultation on learning outcomes with the instructor. In this phase, the instructor acts as a facilitator and mentor, assisting students in understanding the material learned and addressing any challenges that arise during the learning process. Constructivism can be used to identify errors and enhance students' understanding, while cognitive theory aids in understanding how students process information and how information can be stored and transferred from short-term to long-term memory.

Phases three, four, and five are conducted face-to-face in a computer lab in a single session. Students work in small groups during the third phase and complete individual tasks in the fourth phase. Subsequently, in the fifth phase, they engage in discussions with the instructor about their learning outcomes and receive feedback.

Evaluation Phase

The final phase in the blended learning model is the assessment of learning, which can be conducted both online and offline. This assessment can take the form of formative or summative evaluation. Formative assessment is performed periodically during the learning process and serves as a tool for monitoring student progress and development. In formative evaluation, instructors provide continuous feedback and offer students opportunities to enhance and improve their performance.

On the other hand, summative assessment is conducted after the learning process is completed and serves as a tool to evaluate students' understanding and their ability to apply the learned material. In summative evaluation, instructors assess students' abilities through the assignment of grades or scores.

In this context, behaviorist theory can be used as a foundation for providing feedback to students, both in formative and summative evaluation.

Instructors can provide clear and specific feedback on student performance by assigning grades or offering constructive feedback, along with providing positive reinforcement for the progress achieved by students. In this regard, technology can also be utilized to provide fast and effective feedback, such as through email or instant messaging applications.

Regarding the determination of teaching strategies, the researcher designed the syntax of BLMAGC, which was crafted based on the learning structure. The syntax can be observed in the following Table 2:

Table 2. Syntax of BLMAGC

The syntax in the knowledge construction phase (online) of BLMAGC for the computer application course, depicting the roles of the instructor and students:

Lecturer's Roles:

- Gathering relevant reference materials for the Computer Applications course and uploading them to Google Classroom.
- Providing instructions and explanations regarding the first phase of the blended learning model based on constructivist theory, including the objectives and expectations from students.
- Facilitating online discussions to address the material and moderating the discussions to stay on track with the predetermined topics.
- Offering feedback and support to students as they reflect on their prior experiences and existing knowledge.

Students' Roles:

- Reading and studying the reference materials uploaded by the instructor on Google Classroom.
- Paying attention to and considering how these concepts relate to prior knowledge and reflecting on prior experiences and information.
- Actively participating in online discussions on Google Classroom by expressing opinions and exchanging ideas with fellow students.
- Preparing questions or responses for online discussions and asking the instructor if there are any aspects of the provided reference materials that are not understood.

The syntax in the modeling phase (online) of BLMAGC for the computer

application course, illustrating the roles of the instructor and students:

Lecturer's Roles:

- Collecting relevant case examples and case studies for the Computer Applications course and uploading them to Google Classroom.
- Providing instructions and explanations regarding the second phase of the blended learning model based on behaviorist theory, including the objectives and expectations from students.
- Explaining how the provided case examples and case studies relate to the concepts students have learned.
- Facilitating online discussions and activities related to the case examples and case studies, and moderating discussions to stay on track with the predetermined topics.
- Offering feedback and support to students as they engage with the case examples and activities provided.

Students' Roles:

- Following the case examples and case studies provided by the instructor and engaging in related activities.
- Considering and comprehending how the learned concepts can be applied in real-life situations through the provided case examples and activities.
- Actively participating in online discussions on Google Classroom by expressing opinions and exchanging ideas with fellow students about their experiences with the provided case examples and activities.
- Preparing questions or responses for online discussions and asking the instructor if there are any aspects of the provided case examples and activities that are not understood.

The syntax in the face-to-face collaborative learning and practical application phase of BLMAGC for the computer application course that illustrates the roles of the instructor and students:

Lecturer's Roles:

- Explaining the concepts of collaboration and knowledge construction based on constructivist and connectivism theories to students.

- Organizing and facilitating the formation of small student groups.
- Assigning collaborative tasks and projects to be completed.
- Guiding and providing feedback on the progress and performance of students in the collaborative learning process.

Students' Roles:

- Interacting with group members and collaborating to collectively learn and apply the material.
- Sharing their ideas, experiences, and understanding with other group members.
- Working on tasks and projects collaboratively with fellow group members.
- Posing questions and seeking guidance from the instructor in case of difficulties or confusion during the collaborative learning process.

The syntax during the phase of individually studying and practicing course materials (in-person) from BLMAGC for the computer application course, depicting the roles of the instructor and the students:

Lecturer's Roles:

- Explaining the concepts and materials to be studied by the students.
- Assigning individual tasks that involve processing information and making independent decisions.
- Assessing students' understanding of the material by presenting questions or quizzes.

Students' Roles:

- Following the explanations and materials provided by the instructor.
- Completing individual assignments given by the instructor.
- Identifying problems and solutions and making decisions based on their understanding of the material.

The syntax during the phase of consulting learning outcomes with the instructor (in-person) in BLMAGC for the computer application course, outlining the roles of the instructor and the students:

Lecturer's Roles:

- Serving as a facilitator and mentor in learning outcome consultations.
- Assisting students in understanding the material they have studied.
- Resolving issues that arise during the learning process.
- Applying constructivism theory to help identify errors and improve students' understanding.
- Utilizing cognitivism theory to aid students in comprehending how information is processed and stored.

Students' Roles:

- Attending learning outcome consultations with the instructor.
- Discussing the comprehension of the material and issues that arise during the learning process.
- Identifying errors and improving understanding with the assistance of constructivism.
- Understanding how information is processed and stored with the aid of cognitivism.

The syntax of learning evaluation (both online and in-person) in BLMAGC for the computer application course, illustrating the roles of the instructor and the students:

Lecturer's Roles in the Stage of Learning Evaluation

- Conducting both formative and summative assessments of students.
- Providing regular feedback to students during the learning process.
- Assigning grades or scores to students upon the completion of the learning process.
- Offering positive reinforcement for the progress made by students.
- Leveraging technology, such as email or instant messaging applications, to provide swift and effective feedback.

Students' Roles in the stage of Learning Evaluation

- Receiving periodic feedback from the instructor throughout the learning

process.

- Improving and enhancing their learning performance based on the feedback provided by the instructor.
- Completing formative and summative assessments provided by the instructor.
- Receiving grades or scores from the instructor upon the completion of the learning process.
- Utilizing feedback from the instructor to enhance learning performance and deepen their understanding of the material.

Student and Environmental Analysis

In the Student and Environmental Analysis phase of the Dick's et al. model,[29] the researcher analyzed student characteristics (intelligence level, educational background, etc.), the learning environment (facilities, resources), and learning challenges. Additionally, the researcher understood students' needs related to learning styles, learning resources, and learning media preferences. The goal was to develop responsive instruction that assisted students in achieving learning objectives and enhanced the effectiveness of the learning process.

Defining Performance Objectives

Based on the instructional structure, syntax, and student analysis results, the researcher established performance objectives of BLMAGC as presented in Table 3 below:

Table 3. Performance Objectives of BLMAGC

Performance Objectives:
• Students can clearly explain the use of computer applications in daily life and business through compelling and informative visual media presentations.
• Students can proficiently and efficiently operate productivity applications such as word processors, spreadsheets, presentation software, and project management applications in both individual and group assignments.
• Students can skillfully operate creative applications for photo editing, graphic design, and animation, producing appealing creative products in

[29] Dick, Carey, and Carey.

both individual and group assignments.

- Students can apply design principles to create captivating creative products in both individual and group assignments.
- Students can analyze problems and determine the most appropriate applications for solving these issues in both individual and group assignments.

Product Development (Stages 5 - 10)

Development of Tests and Parameters

In the stage of developing tests and parameters as aligned with the Dick's et al. model,[30] the researcher established measurable success indicators, selected the types of tests appropriate for the skills being assessed, created clear test instructions, and tested their validity and reliability through representative student trials. The results of developing tests and parameters can be accessed at the following link: https://shorturl.at/chOST

Development of a Blended Learning Model Assisted by Google Classroom Application to Improve Learning Achievement in the Computer Application Course

Based on the preliminary study results presented earlier, the developed BLMAGC is depicted in the form of a concept map as shown in Figure 1 below:

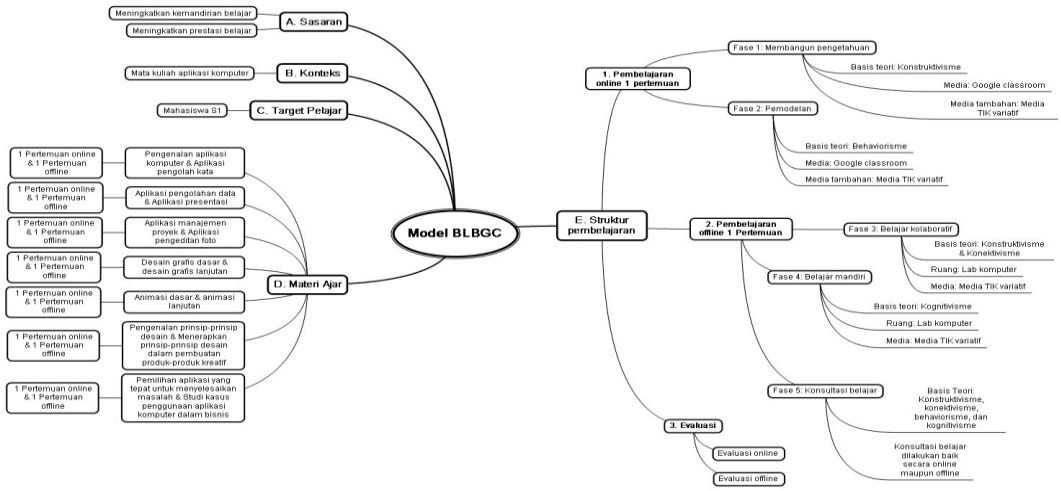

Figure 1. BLMAGC Design

[30] Dick, Carey, and Carey.

The development of BLMAGC for the computer application course was designed in the form of a model book as a prototype, and this model book can be accessed at the following link: https://shorturl.at/chOST

The validation process of the prototype of the blended learning model assisted by Google Classroom for the computer application course, using the Delphi method, was carried out through three distinct stages. The initial stage involved a Focus Group Discussion (FGD) that engaged 5 education experts, consisting of 3 experts in information and communication technology education and 2 experts in curriculum and teaching materials. Based on the FGD results, the recommendations from the experts for improving the GISTEM learning model prototype are presented in Table 4 below:

Table 4 Recommendations and Follow-Up for Improving BLMAGC

No	Aspect	Suggestions for Improvement	Follow-Up Activities
1	Background Model	In developing BLMAGC, it is important to consider all relevant elements of learning theory.	Revisiting learning theories and determining that the BLMAGC encompasses learning principles based on Constructivism, Behaviorism, Cognitivism, and Connectivism theories.
2	Model Epistemology	Provide a rational argument regarding the integration of the syntax synthesis results of BLMAGC.	Creating a detailed explanation of the BLBGC model's syntax, where the syntax developed is referenced to the four theoretical approaches that underlie the BLBGC model, namely Constructivism, Behaviorism, Cognitivism, and Connectivism theories.
3	Model Theoretical Foundation	Provide a more detailed explanation regarding the functions of Constructivism, Behaviorism, Cognitivism, and	Creating an explanation with a presentation flow that interconnects the four learning theories underpinning the model. The related explanation is presented in the BLBGC model book.

		Connectivism theories that underpin the BLBGC model.	
4	Model Syntax	The model syntax is good but separate the roles of the instructor and the roles of the students in its details.	Create a detailed explanation in the model book in the section presenting syntax, where the researcher outlines the syntax based on the roles of the instructor and the roles of the students.
5	Supporting Factors of the Model	Please complete the model with a presentation of instructional materials that can be further developed by the teaching instructor.	Summarizing the instructional material that will be further developed and customized by the instructor, and the summary is presented in the BLBGC model book.

The second stage in the Delphi method was conducted through a consultation for improvement with the FGD Team. Meanwhile, the third stage of the Delphi process aimed to test the content validity of the BLBGC learning model. The content validity of this learning model was assessed by analyzing the extent to which the panelists' decisions were related to the indicators of BLBGC learning model development. The panelists involved in the validation of the feasibility of the learning model consisted of 8 experts, comprising 4 internal experts and 4 external experts. Internal experts were from the State Islamic Institute of Curup, while external experts were from the University of Bengkulu. The results of the panelists' analysis of the BLBGC learning model are presented. in Table 5 below:

Table 5. Panelist Divergence Analysis of the BLBGC Model

No	Indicators	Panelists								DS	IR	R%	Decision		
		1	2	3	4	5	6	7	8				DS	IR	R%
1	Clarity of the model background	4	4	3	4	4	4	3	4	0.46	0.25	86	Div	Div	Reliable
2	Clarity of the model's	4	4	4	4	4	4	4	4	0.0	0.0	100	Div	Div	Reliable

	objectives														
3	Clarity of the model's benefits	3	4	4	4	4	3	4	4	0.46	0.25	86	Div	Div	Reliable
4	Clarity of the model's ontology	4	4	4	4	4	4	3	3	0.46	0.25	86	Div	Div	Reliable
5	Clarity of the model's epistemology	4	4	4	4	4	3	3	4	0.46	0.25	100	Div	Div	Reliable
6	Clarity of the model's axiology	4	4	3	3	4	4	3	4	0.52	1	86	Div	Div	Reliable
7	Clarity of the model's theoretical foundation	3	4	4	4	4	4	3	3	0.52	1	86	Div	Div	Reliable
8	Completeness of the model components	4	4	4	4	4	4	4	4	0.0	0.0	100	Div	Div	Reliable
9	Clarity of the model syntax	4	4	4	4	4	3	4	4	0.35	0.0	100	Div	Div	Reliable
10	Clarity of the social system of the model	3	4	3	3	4	4	3	4	0.53	1	86	Div	Div	Reliable
11	Clarity of the reaction principles of the model	4	4	3	4	4	4	3	4	0.46	0.25	86	Div	Div	Reliable
12	Clarity of the model's supporting factors	3	4	4	3	4	3	3	3	0.52	1	86	Div	Div	Reliable
13	Clarity of the instructional impact of the model	3	4	4	4	3	4	3	4	0.52	1	86	Div	Div	Reliable

* DS = *deviation standard*, IR = *interquartile range*, dan R = *percentage of agreement*

The R score (percentage of agreement) in the table above indicated that 31% of the BLBGC model indicators fell into the category of "highly suitable," while 69% were categorized as "suitable." Indicators that fell into the "highly suitable" category included the clarity of the model's objectives, the epistemological clarity of the model, the completeness of model components,

and the clarity of the model's syntax. Meanwhile, the other indicators were categorized as "suitable." Therefore, all BLBGC model development indicators met content validity.

The construct validity of the statements for the BLBGC model development indicators was assessed using Item Response Theory (IRT). Information regarding the difficulty levels and item discrimination of the GISTEM model development indicators is presented in Table 6 below.

Table 6. Difficulty Levels and Item Discrimination of BLBGC Model Indicators

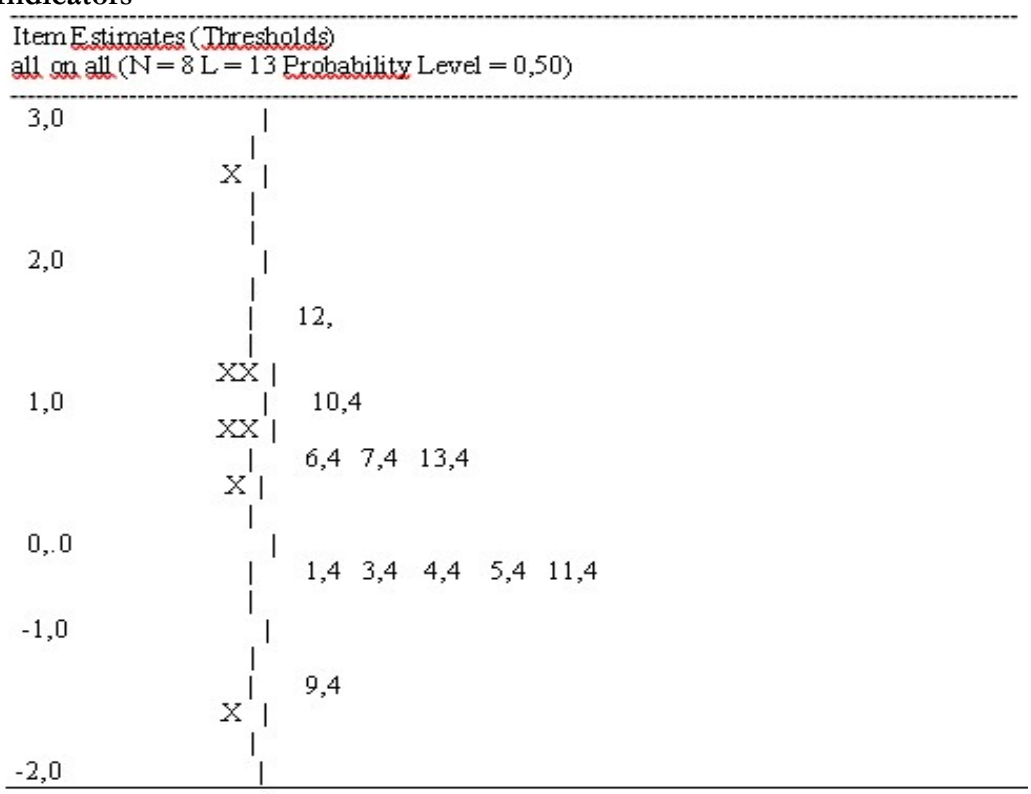

Table 6 above indicates that BLBGC model development indicators number 6, 7, 13, and 10 exhibited a relatively high level of disagreement among the panelists. On the other hand, model development indicators number 1, 3, 4, 5, and 11 were easily agreed upon by the panelists. One of the questions that received a "very easy" agreement rating from the panelists was indicator number 9. To assess the content validity of the BLBGC learning model, it was important to consider the alignment of these development indicators with the Rasch model. The alignment of BLBGC model development indicators with the Rasch model can be observed in Table 7 below:

Table 7. Distribution of Indicator Suitability of BLBGC Model

INFIT MNSQ	0,56	0,63	0,71	0,83	1,00	1,20	1,40	1,60	1,80
1 item 1			.*	|	.				
3 item 3			.	|	.	*			
4 item 4			.	* |	.				
5 item 5			.*	|	.				
6 item 6			.	|*	.				
7 item 7			.	* |	.				
9 item 9			.	|	.	*			
10 item 10			.	* |	.				
11 item 11			.*	|	.				
12 item 12			.	* |	.				
13 item 13			.	|	* .				

From Table 7 above, it is evident that 85% of the BLBGC model development indicators aligned with the Rasch model, while 15% did not conform to the Rasch model. The indicators that did not conform to the Rasch model were indicators number 3 and number 9, as their values fell outside the range of 0.77 to 1.33. Therefore, it was necessary to make improvements to indicator number 3, which related to the clarity of the model's benefits, and indicator number 9, which pertained to the clarity of the model's syntax. Some model development indicators received perfect scores from the panelists, namely indicators number 2 and number 8. The results of the BLBGC model's reliability test indicated a Cronbach's Alpha (α) value of 0.82. With a Cronbach's Alpha (α) value exceeding 0.7, it could be concluded that the BLBGC learning model was highly reliable.

Developing and Selecting Teaching Materials

Based on the introductory phase and the development phase of the BLBGC model design, the formulated teaching materials are presented as shown in Table 8 below:

Table 8. BLBGC Model Materials

Meeting	Materials	Learning Modes
1 and 2	Introduction to computer applications and word processing	The introduction to computer applications and word processing applications is learned using the blended learning model assisted by Google Classroom. One session is conducted through face-to-face learning, while another session is

	applications	carried out through online learning using the Google Classroom application.
3 and 4	Data processing and presentation application	Data processing and presentation application. The materials for data processing and presentation applications are studied using the blended learning model assisted by Google Classroom. One session is conducted through face-to-face learning, while another session is carried out through online learning using the Google Classroom application.
5 and 6	Project management and photo editing applications	The materials for project management and photo editing applications are studied using the blended learning model assisted by Google Classroom. One session is conducted through face-to-face learning, while another session is carried out through online learning using the Google Classroom application.
7 and 8	Basic graphic design and advanced graphic design	The materials for basic graphic design and advanced graphic design are learned using the blended learning model assisted by Google Classroom. One session is conducted through face-to-face learning, while another session is carried out through online learning using the Google Classroom application.
9 and 10	Basic animation and advanced animation	The materials for basic animation and advanced animation are studied using the blended learning model assisted by Google Classroom. One session is conducted through face-to-face learning, while another session is carried out through online learning using the Google Classroom application.
11 and 12	Introduction to design principles and Applying design principles in creating	The materials for the Introduction to design principles and Applying design principles in creating creative products are learned using the blended learning model assisted by Google Classroom. One session is conducted through face-to-face learning, while another session is carried out through online learning using the

	creative products	Google Classroom application.
13 dan 14	Selecting the appropriate applications to solve problems and Case studies of computer application usage in business	The materials for Selecting the appropriate applications to solve problems and Case studies of computer application usage in business are studied using the blended learning model assisted by Google Classroom. One session is conducted through face-to-face learning, while another session is carried out through online learning using the Google Classroom application.

Formative Evaluation for Testing the Prototype of the BLBGC Model for the Computer Applications Course

Formative evaluation in the development model involved limited testing and extensive testing. Limited testing consisted of two phases, namely testing in one class and three classes. The evaluation covered the alignment of the lesson plan, teaching materials, methods, and learning media. The testing process involved syntax testing, observation of the learning process, as well as student and teacher responses. The evaluation also included the assessment of teaching materials and student worksheets. Subsequent testing of the BLBGC was conducted over 6 sessions with online (odd) and offline (even) learning. Pretests were administered during the odd sessions, and post-tests during the even sessions, covering topics such as word processing, data, presentation, project management, and photo editing. The results of limited testing in terms of student self-directed learning indicated that t-test results showed a significant difference between pretest and post-test scores in each session (Sig < 0.05). Post-test scores were higher than pretest scores, demonstrating an improvement in students' self-directed learning with the BLBGC model. Empirically, this model had a positive impact on learning outcomes. In the limited testing of one class, this model significantly influenced student self-directed learning. Furthermore, the results of limited testing in terms of student learning achievement indicated that t-test results showed a significant difference between pretest and post-test scores in each session (Sig < 0.05). Post-test scores were consistently higher than pretest scores, indicating an improvement in student learning outcomes through the BLBGC model with concept mapping. Empirically, the implementation of this model had a positive impact on student learning outcomes in the Islamic Education Management Study Program.

Testing the Effectiveness of the BLBGC Model

Large-group testing was conducted through an experiment using a pretest-posttest control group design. Two groups, the experimental and control groups, consisted of students from the MPI, PAI, and TBI programs who were taking the computer applications course. The experimental group applied the BLBGC model, while the control group used the conventional model. Data were collected through post-tests with a self-directed learning questionnaire and observation of the learning process. The final test results were used to measure effectiveness. Questionnaire results showed a satisfactory level of acceptance from students in the experimental group.

Regarding the aspect of student self-directed learning, the t-test results indicated a significant difference between the experimental group (average test score: 79.81) and the control group (average test score: 66.49). Levene's Test showed equal variance in both groups ($p = 0.062 > 0.05$). The t-value was 7.017 with a significance level of 0.000 (< 0.05), indicating a significant difference. Thus, the BLBGC model was effective in enhancing student self-directed learning in the computer applications course.

In terms of student learning achievement, the t-test results indicated a significant difference between the experimental group (average test score: 80.50) and the control group (average test score: 68.45). Levene's Test showed equal variance in both groups ($p = 0.075 > 0.05$). The t-value was 7.245 with a significance level of 0.000 (< 0.05), indicating a significant difference. Therefore, learning using the BLBGC model was effective in improving student learning achievement in the computer applications course.

DISCUSSION

This research presents four problem formulations related to the development of the Blended Learning Assisted by Google Classroom model. The first focus is to find the appropriate blended learning model to enhance students' self-directed learning in computer application practice by combining constructivist theory and connectivist theory. A student-centered approach, problem-based or project-based learning, and the use of technology are keys to improving students' self-directed learning. Collaboration with peers is also introduced as part of the learning process. Instructors play the role of guides in helping students build their own knowledge through reflection and discussion.

In the computer application course, a constructivist approach is applied by encouraging students to actively seek, explore, and build their own

knowledge.[31] Problem-based learning and collaboration with peers are also used to solve problems together and achieve learning goals.[32] Technology and digital resources support the implementation of constructivism by providing broad access to explore computer applications. Additionally, connectivist theory also plays a role in enhancing students' self-directed learning through interactions with resources and others through a wide network.[33]

In the context of applying connectivist theory, students can leverage technology and digital resources such as the internet, online learning platforms, and computer tools-applications to access information and learning resources.[34] They can search for relevant information, tutorials, and case studies and participate in online forums or discussion groups to share knowledge with fellow students or professionals in the field. Collaboration and social networks also play a crucial role in this context.[35] Students can engage in collaboration with peers, both directly and through online platforms, to share knowledge, solve problems, and support each other in understanding and applying computer application concepts. Additionally, a project-based or open-task learning approach can be applied to enhance students' self-directed learning. Students are given complex projects or tasks that require them to find solutions, integrate concepts, and produce relevant products. In this process, they need to utilize available resources, interact with peers, and develop critical thinking and problem-solving skills. By utilizing technology, collaborating with peers, and engaging in project-based learning, students can develop their self-directed

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[31] M. Pande, "Theoretical Foundations of Design Thinking – A Constructivism Learning Approach to Design Thinking," *Thinking Skills and Creativity* 36 (2020): 1871–1871, https://doi.org/10.1016/j.tsc.2020.100637; Martyn Stewart, "Understanding Learning:: Theories and Critique," in *University Teaching in Focus* (Routledge, 2021), 3–28.

[32] M. Givi Efgivia et al., "Analysis of Constructivism Learning Theory," in *1st UMGESHIC International Seminar on Health, Social Science and Humanities (UMGESHIC-ISHSSH 2020)* (Atlantis Press, 2021), 208–12.

[33] Frederique Corbett and Elio Spinello, "Connectivism and Leadership: Harnessing a Learning Theory for the Digital Age to Redefine Leadership in the Twenty-First Century," *Heliyon* 6, no. 1 (2020): e03250; Jeff Utecht and Doreen Keller, "Becoming Relevant Again: Applying Connectivism Learning Theory to Today's Classrooms.," *Critical Questions in Education* 10, no. 2 (2019): 107–19.

[34] Ahmed Mohamed Fahmy Yousef, Radwa Amir Salah, and Eman Mohammed Makram, "Investigating Different Educational Blog Characteristics to Support Collaborative Learning Based on Connectivism Learning Theory.," in *CSEDU (2)*, 2020, 118–29.

[35] Stephen Downes, "Recent Work in Connectivism," *European Journal of Open, Distance and E-Learning (EURODL)* 22, no. 2 (2019): 113–32.

learning through connections with resources, social interactions, and the application of concepts in real-world situations.[36]

In the context of addressing the second problem formulation, the researcher broadens the theoretical construct of learning in the BLBGC model by incorporating two important theories: behaviorism and cognitivism, which are closely related to students' academic performance in computer application courses based on theory and practice. Concerning behaviorism theory, in computer application courses, its application emphasizes the importance of delivering clear and structured information and instructions.[37] Instructors play a role in providing systematic explanations of computer application concepts and functions, using structured teaching methods to acquire a solid understanding. Feedback or reinforcement is also emphasized as an essential aspect,[38] and technology can be leveraged to provide fast and effective feedback. Additionally, repeated learning or periodic practice is an effective strategy to enhance learning outcomes. Collaboration and cooperative learning are also essential parts of behaviorism theory. Regarding cognitivism theory, its application emphasizes understanding, organizing materials, using active learning strategies,[39] and providing informative feedback.[40] These four fundamental theories, namely constructivism, connectivism, behaviorism, and cognitivism, are integrated into a learning system that is suitable for computer application courses, creating the BLBGC model structured with the necessary content and framework.

The Blended Learning Assisted by Google Classroom model for computer application courses aims to enhance the effectiveness and efficiency of student learning based on four learning theories: constructivism, behaviorism, cognitivism, and connectivism. The first phase focuses on knowledge construction based on constructivism, with students reading reference materials, reflecting on the connections between concepts, and participating in online

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[36] Yousef, Salah, and Makram, "Investigating Different Educational Blog Characteristics to Support Collaborative Learning Based on Connectivism Learning Theory."

[37] Francisco C. Eugenio Jr and Ardhee Joy T. Ocampo, "Assessing Classcraft as an Effective Gamification App Based on Behaviorism Learning Theory," in *Proceedings of the 2019 8th International Conference on Software and Computer Applications*, 2019, 325–29.

[38] Pinton Setya Mustafa, "Implementation of Behaviorism Theory-Based Training Learning Model in Physical Education in Class VII Junior High School Football Game Materials," *COMPETITOR: Jurnal Pendidikan Kepelatihan Olahraga* 13, no. 1 (2021): 39–60.

[39] Danial Hooshyar et al., "The Potential of Open Learner Models to Promote Active Thinking by Enhancing Self-Regulated Learning in Online Higher Education Learning Environments," *British Journal of Educational Technology* 50, no. 5 (2019): 2365–86.

[40] Shulin Yu, "Learning from Giving Peer Feedback on Postgraduate Theses: Voices from Master's Students in the Macau EFL Context," *Assessing Writing* 40 (2019): 42–52, https://doi.org/10.1016/j.asw.2019.03.004.

discussions. The second phase, based on behaviorism, involves modeling with case examples and case studies that illustrate the application of concepts in real-life situations. The third phase, based on constructivism and connectivism, involves collaborative learning and practice in small groups. The fourth phase, based on cognitivism, encourages individual information processing and decision-making. The fifth phase involves consultations with instructors to aid in understanding and problem-solving. Phases three, four, and five are conducted face-to-face in a computer lab. The final phase includes online or offline learning evaluations in the form of formative and summative assessments. The BLBGC model is accessible as a validated module book that has been revised to become an ideal model for enhancing students' self-directed learning and learning achievements in computer application courses.

The researcher tested the BLBGC model in two stages: limited testing and effectiveness testing, focusing on students' self-directed learning and learning achievements in computer application practice. The first limited testing phase emphasized enhancing self-directed learning with concept mapping through 6 blended learning sessions, resulting in significant improvement. The second limited testing, also with concept mapping, evaluated improvements in learning achievements through 6 blended learning sessions, also with significant results. Effectiveness testing using SPSS software showed a significant difference between the experimental and control groups in both testing stages. Furthermore, Google Classroom was used in this model for online learning, providing easy access to materials, interaction, collaboration, as well as assignment and assessment features that support self-directed learning and improved learning achievements. Thus, Google Classroom helps reinforce students' self-directed learning and learning achievements in computer application education.

This research has successfully developed a blended learning model assisted by Google Classroom for the computer application course, with a focus on several core principles. This model emphasizes the construction of a pedagogical framework based on fundamental concepts, setting broad and customized learning objectives, adapting the educational paradigm to contemporary social and cultural realities, optimizing the educational structure, and structured learning schedule planning. The model consists of two phases: an online/offline asynchronous phase and a face-to-face synchronous phase through the Google Classroom platform. Furthermore, the model integrates principles of feedback, support systems, and social systems into the learning process. The instructional impact of this research is evident through the increased self-directed learning and learning achievements of students in the computer application course, as well as providing greater flexibility and

improved interaction in the learning process. This model makes a positive contribution to changing student learning outcomes through the utilization of blended learning and the development of student self-directed learning.

CONCLUSION

This research aims to develop the Blended Learning Assisted by Google Classroom Application (BLBGC) model to enhance students' self-directed learning and performance in the computer applications course. The research is oriented towards four main aspects. Firstly, the development of an appropriate blended learning model to enhance students' self-directed learning in practical computer applications. Secondly, the development of an appropriate blended learning model to improve students' academic performance. Thirdly, the development of an effective blended learning model to enhance students' self-directed learning in practical computer applications. Fourthly, the development of an effective blended learning model to improve students' academic performance in practical computer applications.

In addressing the first problem statement, the researcher developed a model framework by integrating constructivism and connectivism theories. Constructivism emphasizes the active role of students in constructing their own knowledge, while connectivism acknowledges the importance of interaction with resources and others through a wide network. Regarding the second problem statement, the researcher added constructs from behaviorism and cognitive theories into the BLBGC model. Behaviorism theory focuses on observable changes in behavior as a result of learning, while cognitive theory emphasizes understanding, information processing, and the development of students' thinking.

To address the third and fourth problem statements, the researcher tested the BLBGC model in two stages: limited testing and effectiveness testing. The results of the limited testing indicated a significant improvement in students' self-directed learning and academic performance. The use of the Google Classroom application in the blended learning model provides significant benefits in enhancing students' self-directed learning and academic performance. This model is based on the principles of concept-based learning, comprehensive learning objectives, adjustment of educational paradigms to social and cultural realities, optimization of available resources, and well-planned learning schedules. The instructional impact of this research is evident through the enhancement of students' self-directed learning and academic performance in the computer applications course.

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