

# Developing and validating the ACCA (Activation-Collaboration-Creation-Application) learning model to enhance students' collaboration

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**Abstract:** Collaboration skills are crucial for students to engage in teamwork, solve problems collectively, and construct deeper understanding through interactive discussions. However, existing research indicates that these skills remain underdeveloped, primarily due to lecturer-centered teaching approaches and limited social interaction—particularly in subjects like animal physiology. This study aims to develop and validate the ACCA (Activation–Collaboration–Creation–Application) learning model as a valid, practical, and effective framework for enhancing student collaboration. Employing a Research and Development (R&D) methodology based on the Plomp and Nieveen (2013) model, the study proceeded through three phases: Preliminary Research, Prototyping, and Assessment. The model was validated by experts, tested for practicality, and evaluated for effectiveness through classroom implementation. The results indicate that the ACCA model meets the criteria for validity, practicality, and effectiveness in improving students' collaborative competence. It significantly fosters active engagement, mutual problem-solving, and shared knowledge construction. The ACCA model offers an innovative and adaptable instructional strategy applicable across various disciplines by promoting a more interactive and structured learning environment.

**Keywords:** ACCA model; collaborative learning; instructional design; students' collaboration skill

## 1. Introduction

Collaboration skills refer to an individual's ability to work effectively with others to achieve shared goals (Alozie et al., 2020). These skills encompass clear communication, mutual respect, active listening, and the capacity to share ideas and provide constructive feedback (McManus & Aiken, 2016). In educational settings, collaboration is crucial in enabling students to solve problems collectively, integrate diverse perspectives, and develop a deeper understanding through interactive discussions. Beyond academic success, collaboration fosters essential social attitudes such as empathy, trust, and teamwork—skills that are critical in today's increasingly interconnected and complex world (Grand-Guillaume-Perrenoud et al., 2024). Through collaborative learning, students not only acquire academic knowledge but also develop the interpersonal competencies necessary to become empathetic, productive members of society.

Effective classroom collaboration requires student-centered learning environments that stimulate engagement and peer interaction (Mertz et al., 2023). When students are encouraged to contribute ideas within group tasks and are held accountable for shared outcomes, they not only become co-creators of knowledge but also improve their ability to produce meaningful results (House & Wahl, 2021; Kropp et al., 2016). Through collaborative tasks, students gain experience in shared accountability, mutual decision-making, and constructive peer interaction (Kropp et al., 2016).

However, empirical evidence indicates that students' collaboration skills remain relatively low in various countries, including regions in Indonesia. Erickson et al. (2015) reported a collaboration skill score of just 1.08 in the United States—an indication of

limited ability. Comparable findings were observed in Beijing (Wu et al., 2019) with a score of 1.31, and in Russia (Yanacón-Atía et al., 2017) with a score of 1.26. In Indonesia, the pattern is similar: Hidayati (2019) reported a score of 1.10 in Sumatra, while Santoso et al. (2021) recorded 1.80 in Yogyakarta. A preliminary study conducted by the authors in November 2023 across several universities in Makassar supports these trends, revealing an average collaboration skill score of 1.73—further indicating the widespread deficiency in this critical 21st-century competency.

Several factors contribute to this problem, most notably the prevalence of lecturer-centered instruction, which limits student agency and suppresses meaningful peer interaction (Marra et al., 2016). In such environments, students often have minimal opportunities to interact, share ideas, or work collaboratively. A lack of social interaction and cooperation—both between individuals and within groups—further exacerbates the problem (Acquavita et al., 2023). Additionally, high levels of individualism among students often hinder collaborative efforts in classroom settings, creating an environment where working together becomes a challenge (Acquavita et al., 2023; de Oliveira Pires & do Rosario Rodrigues, 2023). This absence of collaborative empowerment negatively impacts the overall learning process, particularly in courses that demand active engagement, such as Animal Physiology.

The Animal Physiology course requires students to understand complex biological processes occurring within various animal systems—processes that are often encountered in everyday environments (Lu et al., 2022). Simply relying on teacher explanations is insufficient to foster a deep understanding of these physiological mechanisms. Instead, students must be actively involved in seeking information, exploring concepts, and engaging in collaborative problem-solving (Pusparini et al., 2017). Such active learning strategies enable learners to build a more comprehensive and factual understanding of animal physiology (Kaisarevic et al., 2017). Consequently, promoting collaboration in this subject is not only beneficial but essential for meaningful learning outcomes.

The complexity of animal physiology—which involves multiple interrelated systems and intricate physiological mechanisms—makes the material challenging for students to grasp without sufficient visualization and conceptual support (Nuraini et al., 2022). Conventional instructional methods often adopt a teacher-centered and instructive approach, where interaction primarily occurs between the lecturer and individual students, with minimal emphasis on collaborative learning. Although Problem-Based Learning (PBL) encourages teamwork, its effectiveness in fostering meaningful collaboration is limited when the task design does not explicitly promote structured cooperation. As a result, collaborative interactions often become superficial and lack genuine peer-to-peer communication (Aslan, 2021). Similarly, the Direct Instruction (DI) model focuses heavily on passive content delivery by the lecturer, further limiting students' active participation and reducing opportunities for collaborative engagement. These limitations highlight the need for a more structured and interactive learning model—one that intentionally scaffolds collaboration and encourages deeper engagement among students (Sudarmin et al., 2018).

In response to these challenges, this study introduces the ACCA learning model—comprising four key stages: Activation, Collaboration, Creation, and Application. Each stage is designed to engage students cognitively, socially, and practically throughout the learning process. Activation activities aim to stimulate students' cognitive and emotional engagement, preparing them to receive and process new information more effectively. Activation can take various forms, including simple problem-solving tasks, initial group discussions, the use of triggering questions, or exposure to interactive multimedia (Ekatushabe et al., 2021). This stage also fosters an inquiry-based mindset and enhances learning motivation, which is essential for achieving deeper conceptual understanding (Chireac et al., 2022; Torppa, 2020).

Collaboration emphasizes the development of key interpersonal and cognitive skills such as communication, teamwork, and critical thinking. Collaborative activities may involve group discussions, team projects, or interactive simulations that promote active

peer interaction. Successful collaboration requires clearly defined roles, openness to diverse perspectives, and the ability to manage and resolve conflicts constructively (Grand-Guillaume-Perrenoud et al., 2024; Liebeck-Lien & Sjølie, 2021). Through collaboration, students not only engage with the content more meaningfully but also develop essential social competencies by learning from one another (Gusta & Christina, 2020).

Creation allows students to generate original products or solutions by synthesizing and applying their acquired knowledge and skills. This may include presentations, research reports, digital content, or innovative prototypes (Arreola & Reiter-Palmon, 2016; Lattner et al., 2022; Leen et al., 2014). The creation process nurtures creativity, problem-solving, and adaptability—key attributes for contributing to the advancement of science, technology, and innovation (Zaalouk et al., 2021). Application bridges theoretical knowledge with practical implementation. This phase enables students to see the relevance of what they learn by engaging in real-world contexts through case studies, laboratory experiments, simulations, or problem-solving projects (Kim, 2024). Application-based learning is central to experiential education, where students learn by doing and reflecting on their actions, ultimately reinforcing long-term understanding and skill development (Haryani et al., 2018; Tsalapatas et al., 2021).

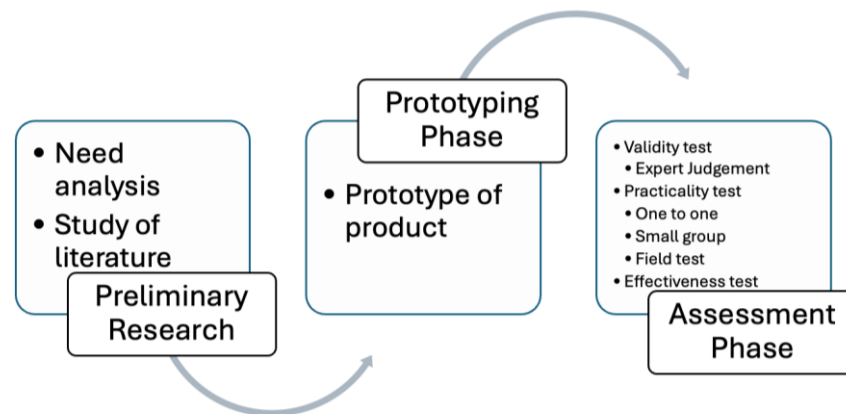
The ACCA learning model was designed to address the limitations of previous instructional approaches such as Problem-Based Learning (PBL) and Direct Instruction (DI), which have not been fully effective in enhancing students' collaboration skills—particularly in the context of Animal Physiology education. While PBL fosters problem-solving and teamwork, it often lacks a structured interaction framework that ensures deep and consistent collaboration among students (Hardianto et al., 2023). Conversely, DI tends to be overly lecturer-centered, minimizing opportunities for student engagement and active participation (Sudarmin et al., 2018).

The development of the ACCA model is grounded in three theoretical foundations: constructivism, cognitivism, and social learning theory. These theories collectively emphasize the importance of active knowledge construction, mental processing, and learning through social interaction. The ACCA model comprises four core phases—Activation, Collaboration, Creation, and Application—that represent a coherent sequence of learning activities designed to shift the learning paradigm from teacher-centered to student-centered. Unlike prior models, ACCA explicitly embeds structured peer interaction across all phases of learning. Its novelty lies in providing a sequenced, holistic model specifically designed to enhance collaboration skills—particularly in complex scientific domains like animal physiology.

Thus, this study aims to develop and validate the ACCA learning model as a pedagogical framework that is valid, practical, and effective in improving students' collaboration skills—particularly within the framework of teaching Animal Physiology. This model offers a new direction for bridging the gap between passive content delivery and active, cooperative learning required in 21st-century classrooms.

## 2. Materials and Methods

This study employed a research and development (R&D) approach to design and validate a learning model. The development process followed the model proposed by Plomp & Nieveen (2013), which was selected for its simple yet flexible structure—making it suitable for developing educational models. The development procedure consisted of three main phases: (1) Preliminary Research, (2) Prototyping Phase, and (3) Assessment Phase (see Figure 1). Each phase was systematically implemented to ensure the model's relevance, feasibility, and effectiveness in supporting student collaboration.



**Figure 1.** The development procedure of ACCA learning model

### 2.1. Preliminary Research

The preliminary research phase involved two primary activities: a needs analysis and a literature review. The needs analysis was conducted to identify the expectations and challenges faced by lecturers regarding the learning models currently used and to assess students' existing collaboration skills. This analysis provided contextual insights into the gaps between current instructional practices and the desired learning outcomes.

In parallel, an extensive literature review was carried out to explore theoretical foundations and empirical findings relevant to collaborative learning and model development. This included examining core learning theories—such as constructivism, cognitivism, and social learning—and reviewing previous studies on learning model effectiveness. The insights gathered from this phase formed the theoretical and empirical basis for the development of the ACCA learning model.

### 2.2. Prototyping Phase

The prototyping phase focused on the design and development of the initial version of the ACCA learning model. This process included the construction of model syntax and the development of supporting instructional tools, such as the syllabus, lesson plans, student worksheets, and a collaboration skills assessment instrument. A formative evaluation was conducted throughout this phase to refine the prototype. Feedback was collected from experts in the fields of education and subject content to assess the model's validity and relevance. The outputs produced in this phase—including the ACCA model and its supporting materials—constitute the prototype intended for further validation in the next phase.

### 2.3. Assessment Phase

The assessment phase represents the final stage of the research and development process. This phase aims to evaluate the validity, practicality, and effectiveness of the developed ACCA learning model and its supporting instruments. Validity was assessed through expert validation, which served as a formative evaluation to gather professional feedback on the model's content, structure, and instructional feasibility. Expert validators were selected based on their backgrounds and alignment with the research context, including experts in biology education, subject matter specialists, and practitioner lecturers. The feedback obtained during this stage was used to revise the product iteratively until the experts confirmed its validity for classroom trials.

Following expert validation, a series of formative evaluations were conducted to examine the practicality of the ACCA model. These included:

1. A one-to-one trial involving 3 students over 2 meetings, where students provided feedback on clarity, usability, and learning experience.

2. A small group trial with 10 students to refine the product based on observed implementation and student responses.
3. A field trial involving 30 students who had completed the Animal Physiology course. This stage provided comprehensive insights into how the model performed in a real classroom setting.

Effectiveness was assessed by comparing the ACCA learning model to the Problem-Based Learning (PBL) and Direct Instruction (DI) models. The study involved 92 students enrolled in the Animal Physiology course during the 2023/2024 academic year, distributed across three parallel classes. Each class was assigned one of the three instructional models: ACCA, PBL, or DI. Students' collaboration skills were observed and measured across 13 sessions using a validated and reliable observation instrument (validity coefficient  $r = 0.456-0.511$ ; reliability  $\alpha = 0.831$ ). To determine the statistical effectiveness of the ACCA model in enhancing collaboration skills, data were analyzed using one-way ANOVA, followed by a Least Significant Difference (LSD) post hoc test. Prior to ANOVA, assumption tests including the normality test and homogeneity of variance test were conducted to ensure the suitability of the data for inferential analysis. The implementation design of the ACCA, PBL, and DI model is presented in Figure 2.

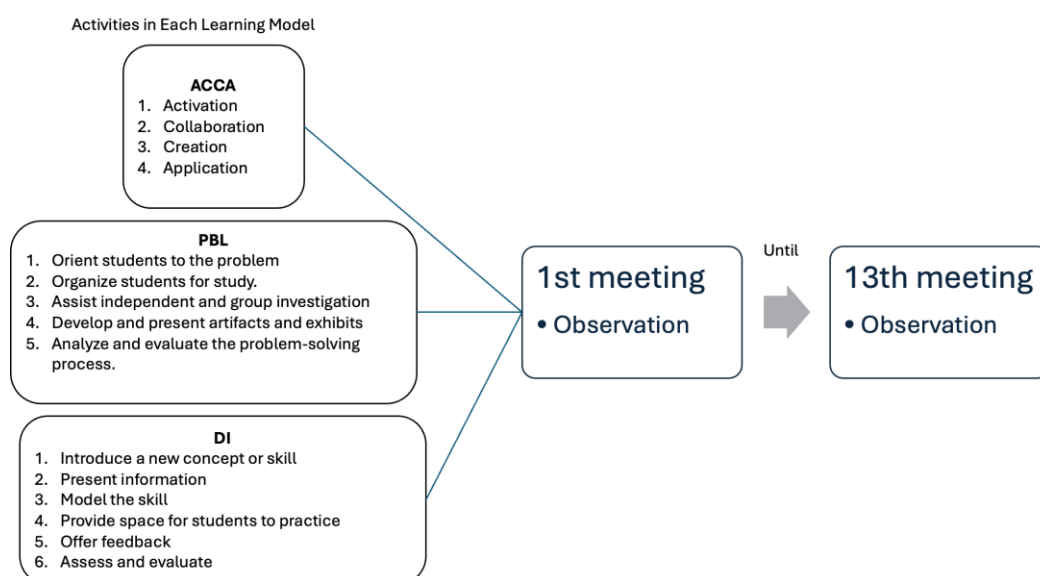


Figure 2. The implementation of ACCA, PBL, and DI learning model

### 3. Results

#### 3.1. Preliminary Research

The initial analysis of student profiles focused on assessing the collaboration skills of students who had completed the Animal Physiology course. The results showed that the average score for students' collaboration skills was 43.38, which falls into the very low category (Table 1). This finding indicates a critical need to improve students' collaborative competencies through more targeted instructional approaches.

Table 1. The average score for students' collaboration skills

No.	Dimensions	Average	Category
1.	Work productively	42.25	Very Low
2.	Show respect	39.25	Very Low
3.	Mutual agreement	42.50	Very Low
4.	Sharing responsibilities	49.50	Low
<b>Total Average</b>		<b>43.38</b>	<b>Very Low</b>

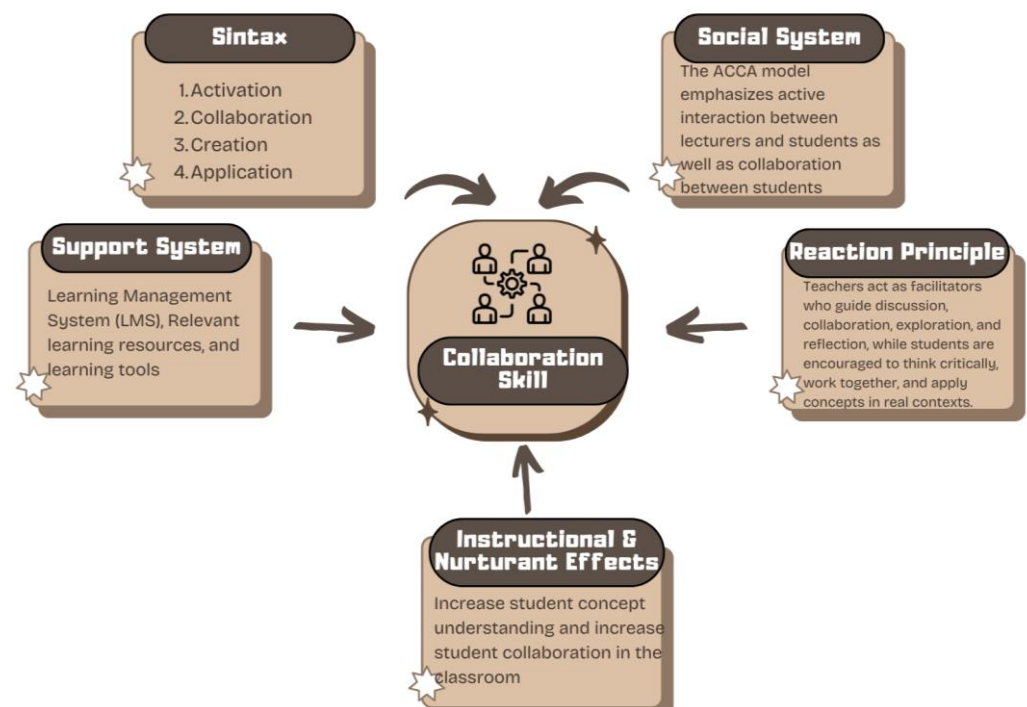
Note: Interval  $81.25 \geq - 100$  (Very High),  $71.60 \geq - 81.24$  (High),  $62.60 \geq - 71.59$  (Medium),  $43.76 \geq - 62.59$  (Low),  $0 - 43.75$  (Very Low) (Aufa et al., 2021)

Furthermore, the analysis of lecturer needs revealed that lecturers require a simpler yet effective learning model that can foster students' collaboration skills. The desired model helps activate students' prior knowledge and prepares them to understand new concepts, provides opportunities for students to collaborate, engage in discussions, and share understanding, and encourages them to construct knowledge through experiential tasks or projects that deepen their conceptual grasp. Additionally, the model should allow students to apply the knowledge they have acquired in real-world contexts, thereby making learning more meaningful and relevant.

The literature review confirmed that the ACCA model is grounded in three major learning theories: constructivism, cognitivism, and social learning theory. These theories provide a solid philosophical and pedagogical foundation for the development of a learning model that emphasizes active student engagement, cognitive processing of information, and social interaction as the basis for meaningful collaborative learning.

### 3.2. Prototyping Phase

The prototyping phase began with the design and development of the ACCA learning model, which includes five core components: (a) syntax, (b) social system, (c) reaction principles, (d) support system, and (e) instructional and nurturant effects (Figure 3). The design of the ACCA model was guided by findings from both theoretical and empirical studies, ensuring that the model is grounded in relevant pedagogical foundations. The detailed steps and components of the ACCA learning model are presented in Table 2.



**Figure 3.** Components of the ACCA learning model

### 3.3. Assessment Phase

The assessment phase yielded results concerning the validity of the ACCA model and its associated learning tools, the practicality of implementation based on student responses, and the model's effectiveness compared to alternative learning approaches. Expert validation confirmed that the ACCA model and its learning instruments are valid. The mean validation scores from expert validators were as follows: (1) ACCA learning model ( $M = 93.05$ ), (2) syllabi ( $M = 98.96$ ), (3) lesson plans ( $M = 92.00$ ), (4) student worksheets ( $M = 93.50$ ), and (5) collaboration skill instrument ( $M = 98.75$ ). The practicality of the ACCA model was determined through one-to-one, small-group, and field testing.

The results indicate a high level of practicality with the following mean scores: one-to-one trial (M = 96.59), small group trial (M = 96.66), and field test (M = 96.96).

**Table 2.** The stages of the ACCA learning model

No.	Stages	Student Activities
1.	Activation	<ol style="list-style-type: none"> <li>1. Students read the teaching materials provided in the LMS and other relevant sources related to the material individually before entering the class.</li> <li>2. Students receive the worksheet distributed by the lecturer.</li> <li>3. Students create mind maps based on the results of the literature study that has been read.</li> <li>4. Students listen to the learning objectives explained by the lecturer.</li> <li>5. Students listen to the lecturer giving short material.</li> </ol>
2.	Collaboration	<ol style="list-style-type: none"> <li>1. Students form groups of 3-4 people.</li> <li>2. Students discuss or share knowledge in groups related to the mind mapping that has been created.</li> <li>3. Students collaboratively identify problems by creating a number of basic questions related to the material to focus on the problem (problem statement).</li> <li>4. Students conduct group discussions to solve problems under the guidance of lecturers.</li> </ol>
3.	Creation	<ol style="list-style-type: none"> <li>1. Students design ideas/concepts as alternative solutions to problems.</li> <li>2. Students are given the freedom to choose ideas/concepts as the most relevant solutions based on theoretical basis.</li> <li>3. Each group presents the results of the work that has been done together with their group and other groups respond. At this stage, the solutions offered can be accepted, improved, redesigned, or even rejected. This stage serves to question again whether the existing solution can answer the problem.</li> <li>4. The lecturer provides reinforcement of the material.</li> </ol>
4.	Application	<ol style="list-style-type: none"> <li>1. Students reflect on what they have understood and the remaining problems.</li> <li>2. Students relate the material to everyday life (in the form of assignments in the form of concepts and examples of their application in everyday life) including identifying the benefits of mastering the concepts that have been learned.</li> <li>3. All students' worksheet is collected as one of the bases for assessing the process.</li> </ol>

The effectiveness of the ACCA model was assessed through classroom implementation using a one-way ANOVA test on student collaboration skills. Before conducting the ANOVA, prerequisite tests were performed: the normality test yielded a p-value of 0.254 (> 0.05), and the homogeneity test produced a p-value of 0.052 (> 0.05), indicating that the data met the assumptions for parametric testing. The one-way ANOVA results showed a statistically significant difference in collaboration skills across the three groups (ACCA, PBL, DI), with a p-value of 0.00 (< 0.05), suggesting that the type of learning model significantly influenced student collaboration. A summary of the ANOVA results is presented in [Table 3](#).

**Table 3.** Summary result of one-way ANOVA for students' collaboration skill

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	615.594	2	307.797	74.133	.000
Within Groups	369.524	89	4.152		
<b>Total</b>	<b>985.118</b>	<b>91</b>			

Further analysis using the Least Significant Difference (LSD) test ([Table 4](#)) revealed that the ACCA model produced significantly higher outcomes than the PBL and DI models. Additionally, the PBL model differed significantly from the DI model. The adjusted mean score for the ACCA model was the highest (M = 55.4174), indicating that

the ACCA learning model is more effective in enhancing students' collaboration skills than the comparison models.

**Table 4.** The results of LSD for students' collaboration skill

No.	Learning Model	Corrected Average	Notation
1.	ACCA	55.4174	a
2.	Problem Based Learning (PBL)	52.6826	b
3.	Direct Instruction (DI)	49.0226	c

#### 4. Discussion

The ACCA (Activation, Collaboration, Creation, Application) learning model is considered valid, as evidenced by the results of expert validation, which indicate that each stage of the model systematically supports an effective learning process. The validity of this model is grounded in its conceptual alignment with established learning theories, namely constructivism, cognitivism, and social learning theory. The ACCA model embodies the core tenets of constructivist and experiential learning, aiming to cultivate students who are independent, innovative, and adaptive. Furthermore, the model supports the development of essential 21st-century competencies, especially collaboration skills, which are increasingly vital in addressing complex global challenges.

The ACCA model is designed to encourage students to comprehend concepts, engage collaboratively, and apply knowledge in real-world contexts. The evaluation of the model's components follows the framework proposed by [Joyce et al. \(2024\)](#), which includes the analysis of its syntax, social system, reaction principles, support system, and both instructional and nurturant effects. The syntax of the ACCA model comprises four sequential stages—activation, collaboration, creation, and application—each focusing on fundamental elements of effective learning.

In the activation stage, students are introduced to core concepts through meaningful triggers, such as reflective questions, contextual case studies, or real-world phenomena. Activation aims to awaken prior knowledge, preparing students to assimilate new information ([Ekatushabe et al., 2021](#)). This stage aligns with constructivist theory, which underscores the importance of connecting new content to existing cognitive structures ([Yakar et al., 2020](#)). The collaboration stage facilitates peer interaction through group tasks and discussions, allowing students to exchange ideas, negotiate meaning, and co-construct knowledge. These interactions foster critical thinking and are rooted in Vygotsky's social constructivist perspective, particularly his Zone of Proximal Development (ZPD), where learning is mediated through scaffolding and social dialogue ([Kim, 2024](#); [Grand-Guillaume-Perrenoud et al., 2024](#)).

In the creation stage, students develop innovative solutions or tangible products that demonstrate their understanding—typically through project-based tasks, simulations, or problem-solving scenarios. This stage emphasizes creative thinking and student autonomy. Finally, the application stage involves implementing the acquired knowledge in authentic settings, such as through experiments, presentations, or community-based projects. This ensures the transfer of learning into practical, real-life situations, thereby reinforcing conceptual mastery.

The social system in the ACCA model emerges through structured student activities guided by the lecturer. The role of the lecturer is multifaceted: acting as a facilitator, motivator, and mediator of classroom dynamics ([Campbell, 2015](#)). Lecturers are instrumental in creating a conducive learning environment, fostering student engagement, and guiding deeper exploration of concepts ([Kranzfelder et al., 2020](#)). Learning within the ACCA model occurs not only through direct experience but also through observation and imitation of peer behaviors ([Mubarak et al., 2022](#); [Widianto et al., 2020](#)). Thus, lecturer support is key to cultivating collaboration skills among students.

The principle of reaction within the ACCA model requires students to actively engage with reading materials and learning resources related to the topic. Collaboration activities provide students the opportunity to share diverse viewpoints and strategies,

thereby deepening their understanding and nurturing essential communication, social, and problem-solving skills (Clevenger et al., 2016). Learning environments that emphasize cooperative endeavors equip students to better confront the demands of the modern world (McGinness et al., 2019).

The support system of the ACCA model includes essential learning tools such as syllabi, lesson plans, student worksheets, and collaborative assessment instruments. These tools are developed in accordance with the ACCA model's syntax to ensure coherence and clarity in implementation. A well-structured support system ensures that the learning process is organized, systematic, and aligned with predetermined educational standards (Cooper, 2022). Such tools facilitate effective lesson planning and execution, enabling educators to manage classroom activities efficiently and drive desired learning outcomes (Großmann & Wilde, 2019; Handayati et al., 2021; Ray & Srivastava, 2020).

Instructionally, the ACCA model significantly improves students' conceptual understanding by guiding them through a structured learning trajectory—from prior knowledge activation to practical application. The nurturant effects of the model include the development of collaborative skills and character traits such as adaptability, creativity, and resilience. Students learn to communicate, negotiate, and problem-solve collaboratively, which not only enhances cognitive growth but also fosters emotional intelligence and team competence (Aufa et al., 2021; Fatmawati et al., 2019; House & Wahl, 2021; Oyarzun & Martin, 2023).

The ACCA model also demonstrates high practicality in classroom implementation. Its flexible, stepwise design supports both problem-based and contextual learning environments. Lecturers can easily adapt each stage to student needs while maintaining time and resource efficiency (Cooper, 2022; Samuels, 2018). The model's adaptability across disciplines and compatibility with various student learning styles enhances its relevance in diverse educational contexts. Grounded in student-centered principles, the ACCA model is well-suited for institutions seeking to implement responsive and dynamic pedagogical strategies (Elnagar et al., 2020; Weinburgh, 2021).

Empirical testing further reveals that the ACCA model is more effective than PBL and DI in enhancing collaboration skills. The model allows students to actively engage in group problem-solving, take ownership of decisions, and build confidence through structured interaction. Unlike PBL, which centers heavily on problem-solving, the ACCA model offers a broader approach that includes conceptual activation and creativity (Aslan, 2021; Hendriana et al., 2018; Rubenstein et al., 2020). Compared to DI, the ACCA model is more student-centered, promoting active participation and minimizing the passivity associated with direct instruction (Sudarmin et al., 2018).

The activation stage includes both online and offline components. Online, students explore materials via LMS and external sources (Hardianto et al., 2024), and collaboratively synthesize this information into mind maps (Hidayati et al., 2020). Offline, students work in groups to develop their mind maps using MFIs, which fosters teamwork and collaborative processing of information (Anwar et al., 2024; Grand-Guillaume-Perrenoud et al., 2024; McGinness et al., 2019).

In the collaboration stage, students build meaningful social interactions—respecting, listening, and responding to peers—which fosters a motivating classroom environment (Alozie et al., 2020; Oyarzun & Martin, 2023). Group discussions promote shared inquiry, critical thinking, and cooperative learning, thereby enhancing both collaboration and cognitive growth (Dickter et al., 2022; Mertz et al., 2023).

During the creation stage, students exchange knowledge and generate ideas to address problems creatively, which further enhances their ability to collaborate (Aslan, 2021; MacMillan, 2014). Trust and mutual respect play key roles in enabling productive team dynamics and problem-solving (Anwar et al., 2024; Grand-Guillaume-Perrenoud et al., 2024).

The application stage consolidates collaborative competencies by requiring students to jointly implement concepts in real-world scenarios. Students divide tasks, assume

leadership roles, and practice effective communication within teams (Aslan, 2021; Liebeck-Lien & Sjølie, 2021; Rubenstein et al., 2020). Group reflection activities further support collaboration by helping students with diverse abilities to support one another and learn from their peers (Lew & Schmidt, 2011).

In summary, across all four stages, the ACCA model consistently engages students in meaningful social interaction with peers and lecturers. This constant engagement cultivates a classroom culture of cooperation and shared responsibility. Through structured reminders and guidance from lecturers, students become increasingly accustomed to sharing perspectives and working collaboratively. Thus, the ACCA model not only enhances students' academic competence but also effectively empowers their collaboration skills—more so than traditional models like PBL and DI.

## 5. Conclusions

This study concludes that the ACCA (Activation, Collaboration, Creation, Application) model is valid, practical, and effective in enhancing students' collaboration skills. Its validity is supported by expert evaluations, which confirm that each phase of the model aligns well with its foundational learning theories—constructivism, cognitivism, and social learning. The model's simplicity and adaptability make it applicable across various learning contexts without requiring complex or high-cost resources, offering lecturers greater flexibility in implementing interactive instruction. The effectiveness of the ACCA model in improving collaboration skills is evident in students' enhanced abilities to communicate, work collaboratively, share responsibilities, and accomplish tasks collectively. Students engaged in ACCA-based learning are more accustomed to discussing ideas, exchanging perspectives, and developing creative solutions—behaviors that are critical to successful teamwork. Data on collaboration skill assessments demonstrate that students taught using the ACCA model show significantly higher levels of participation and cooperation compared to those in other learning models. Thus, the ACCA model not only facilitates conceptual understanding but also meaningfully strengthens students' collaborative competence.

However, this study has several limitations. It was conducted within specific institutional and disciplinary contexts, which may limit the generalizability of the findings. The assessment of collaboration skills was based primarily on observations and group performance evaluations, which may involve some degree of subjectivity. Furthermore, the successful implementation of the ACCA model depends on the active engagement and facilitation skills of both lecturers and students. Therefore, future research is recommended to apply this model across a broader range of subjects and institutions and to employ more objective, diverse, and technology-assisted evaluation methods to assess collaborative learning outcomes.

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