Research Article

The Effectiveness of the (Jigsaw II) Strategy in Cooperative Learning in Developing Thinking Skills and Cognitive Assessment Competencies among Female Students Specializing in Child Education

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Abstract

The present study endeavored to ascertain the effect of employing the Jigsaw II instructional strategy on the augmentation of thinking skills and proficiencies related to cognitive evaluation amongst female undergraduates majoring in Child Education at Al-Balqa Applied University. Implementing a quasi-experimental design, the research engaged a sample of 65 students, all enrolled in the "Play and Child Education" course for the summer term of the 2022-2023 academic year. These participants were arbitrarily allocated into two distinct groups: a control group (n=32), receiving instruction through traditional pedagogical methods, and an experimental group (n=33), experiencing the application of the Jigsaw II strategy. A set of assessments designed to measure thinking skills and cognitive evaluation competencies were administered both prior to and following the intervention for each group. The empirical results gleaned from this study unveil statistically significant disparities at a 0.05 significance level on the cumulative scale in favor of the experimental group. Such findings underscore the efficacy of the Jigsaw II strategy in fostering the development of thinking capabilities and cognitive evaluation competencies amongst female students enrolled in the Child Education specialization at Al-Balqa Applied University, in the context of the "Play and Child Education" course.

Keywords: Educational Effectiveness, Jigsaw II Pedagogical Strategy, Cognitive Thinking Skills Development, Cognitive Evaluation Competencies, Child Education Discipline

1. Introduction

The contemporary landscape is characterized by formidable and unprecedented challenges across multifaceted life domains, emerging predominantly from the transformative revolution encapsulating communication, the knowledge-driven economy, technology, and an exponential proliferation in knowledge and information (Rizvi, 2019). This dynamic panorama indispensably mandates a rejuvenation in the educational sector's foundational structure, ingrained mission, stipulated objectives, and employed strategies, ensuring these are aligned and responsive to the intricacies of the present and anticipated future challenges (Kuzminov, Sorokin, & Froumin, 2019). An imperative facet of this indispensable renewal process involves imbuing education with enhanced flexibility in

curricular planning (Kuzminov, Sorokin, & Froumin, 2019). This flexibility is pivotal for steering students judiciously towards the accurate educational trajectory, ensuring continuity in addressing learners' evolving needs and demands, respecting their unique developmental profiles, and instigating a culture of analysis, interpretation, proactive initiative, and constructive critique amongst them (Kuzminov, Sorokin, & Froumin, 2019).

There is an unequivocal consensus acknowledging the exceptional status accorded to educational specializations, with Child Education specialization being particularly prominent (Shaukat, 2023; Rao, Umayahara, Yang, & Ranganathan, 2021). This distinction is attributed to their consequential role in optimizing the exploitation of children's inherent intellectual capabilities and potentials right from the initial life stages (Shaukat, 2023). This optimization is actualized through the systematic incorporation of cutting-edge methodologies, innovative strategies, and a spectrum of diverse activities into the foundational programs of kindergartens (Shaukat, 2023). Furthermore, the specialization in Child Education inherently embraces a myriad of human dimensions, considering its primary focus is centralized around addressing the holistic needs of the child—encompassing cognitive, psychological, motor, and health-related aspects—as these are unequivocally recognized as not only the quintessential targets of developmental endeavors but also as pivotal to any developmental blueprint within any societal construct (Rao, Umayahara, Yang, & Ranganathan, 2021).

General education is undisputedly central to the educational system, serving as the cornerstone at all stages and providing essential knowledge and guidance to students in shaping their intellectual capabilities and interests (Elhelmi, 2017). When general education successfully becomes a leading producer of knowledge, it signifies not only an improvement in educational and learning processes but also effectively nurtures and fosters a generation enriched with creativity (Kanaan, 2011). This creative generation is proficient at constructing, critically evaluating, and questioning knowledge, exhibiting perseverance in devising solutions for various activities and demonstrating a thorough understanding, implementation, and evaluation of these solutions (Kanaan, 2011).

The responsibility of preparing educators chiefly resides with colleges dedicated to education, with their success measured by their ability to carefully select academic courses designed to enhance students' positive outlook and proactive efficiency (Kanaan, 2011). These courses should act as vital conduits for imparting essential information, fundamental concepts, and undisputed facts, thereby facilitating not only the development of heightened awareness among students but also fostering the growth of positive attitudes (Elhelmi, 2017). Furthermore, such courses should equip students with the necessary skills needed to navigate through various challenges and dilemmas, ensuring they can adapt to different environments and engage in rational thinking, ultimately leading to informed and judicious decision-making (Elhelmi, 2017; Kanaan, 2011).

Therefore, the urgent need arises to incorporate a variety of strategies and activities into the curriculum of programs designed for students majoring in Child Education. This inclusion is crucial for equipping these students both scientifically and professionally with a high level of competency, thereby enabling them to effectively assume their future roles as educators, teachers, counselors, and leaders. A strategy of paramount importance in this context is the Jigsaw II strategy, which has garnered increasing attention from education professionals in recent times. This heightened interest is particularly significant given that a multitude of studies and research efforts have underscored the imperative of utilizing cooperative strategies within the educational setting, more so during the kindergarten phase. This initial phase is pivotal as it is the period during which the foundational elements of a child's personality are laid and subsequently crystallized, setting the stage for the manifestation of their characteristic traits later in life. Given that this phase is optimally suited for fostering the development of students' cognitive, physical, psychological, social, and health-related skills, it is indispensable for preparing them from a tender age to navigate through the challenges of everyday life with a positive disposition. Within this preparatory framework, students are not only encouraged but are also empowered to exercise their thinking skills autonomously, thereby arriving at truths independently. This approach, in turn, facilitates the development of a coherent self-concept and fosters their ability to adapt adeptly to their intrinsic identity (Issa, 2021).

The Jigsaw II strategy is acknowledged as a pivotal component of cooperative learning, exerting a substantial and favorable influence on the progression of the educational-learning process. It markedly shifts the conventional role of the educator from being a passive transmitter of knowledge to actively assuming the roles of guide, mentor, and facilitator in the students' learning journeys. Essentially, the strategy is an embodiment of a cooperative integration method for fragmented pieces of information. It commences with partitioning students into initial groups, each consisting of 5-6 members, wherein each student is entrusted with a specific task or paragraph. This setup then evolves into forming groups with each student assigned different tasks, transforming intricate educational content into a graduated, enjoyable, and comprehensible format for students. Each participant from the initial group is appointed as a member of an 'expert group,' with every expert group being allocated information pertaining to a unique assignment or study material distinct from their counterparts. This strategy effectively prepares them for instructing their original group members, fostering a vibrant exchange of views, ideas, linguistic and scientific expertise, and the distinctive skills inherent to each member. Following this collaborative learning phase, students undergo individual assessments on the subjects they have absorbed, culminating in the assignment of grades or dispensation of rewards for each participant (Hammadneh, 2017).

Jigsaw II is acknowledged as one of the most prevalently utilized strategies within the domain of cooperative learning. This strategy is underpinned by a sequence of steps, initiating with the formation of groups comprised of 5-6 members. Each group member is entrusted with a specific segment of the content for independent understanding and absorption. Following this, the transition to 'expert groups' takes place, wherein individuals are instructed on all topics that fall within the assigned content, with an expectation to subsequently disseminate this knowledge to all members within their respective original groups. Each group engages in a discussion of its allocated content and addresses the associated challenges. Afterward, members from the 'expert groups' are instructed to disband and integrate into assorted and diverse groups, with each member embodying a segment of the content. The crucial points unearthed during previous discussions are then documented. This step is succeeded by an evaluation and discussion of each individual's comprehension of the total content, culminating in a general discussion aimed at deriving the optimum results attained. The process concludes with individual assessments facilitated through a concise quiz post-task completion, with the students' scores contributing positively or negatively to their group's cumulative score, thereby accentuating the significance of each member's role within the group (Al-Swa'edah, Ismail, and Al-Swa'edah, 2021).

Cooperative learning stands as a potent and effective methodology within the spectrum of the learning process, primarily attributing its efficacy to the engendering of positive interactions amongst group participants. It is fundamentally structured upon the division principle, entailing the formulation of diminutive student groups, each consisting of 2 to 6 members. Within this construct, students actively participate in educational activities meticulously designed to galvanize the coordination of their collective efforts. This coordinated approach is pivotal for the attainment of both mutual and individual objectives, realized through the completion of specific tasks or responsive answering of posed questions. To facilitate the realization of optimal achievements, cooperative learning underscores the imperative of both individual and collective responsibility. This dual-responsibility framework is instrumental for fostering mutual support and facilitating the seamless exchange of information among the group's members (Khuzai, Mumeni, and Malhem, 2016).

The cooperative learning strategy endeavors to augment self-esteem among students, cultivate empathy within individual groups and intergroup relations, and construct positive working connections both amongst group members and in relation to the educational content. Achieving these objectives necessitates the educator to undertake roles distinctly divergent from those associated with the traditional competitive learning paradigm. In this context, the educator functions as a supervisor for the distinct sub-groups formed within the class. Concurrently, the educator provides support for students as required, dispenses necessary feedback, oversees collaborative efforts within small groups to mitigate anxiety levels, and fosters a congenial environment conducive

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for collaborative endeavors. This nurturing environment is instrumental in facilitating students' collaborative engagement in assigned educational tasks, thereby establishing a linkage between the learning process and the students' lives, their existential realities, needs, and interests, all within the framework of the prevailing global transformations (Khuzai, Mumeni, and Malhem, 2016; Al-Salamat, 2018).

Murtada and Aweis (2011), alongside Al-Shalabi (2017), posit that thinking skills comprise intricate mental processes that intersect and interact when engaged in thoughtful contemplation. These skills are deliberately utilized to process information and data, aiming to achieve a diverse array of educational objectives. Notably, thinking skills encompass the act of recalling, describing phenomena, notetaking, making predictions, classifying objects, amalgamating elements, and inferring relationships to attain varied educational goals and outcomes. These skills serve as a pivotal key for arming educators with enduring and adaptable knowledge tools, maintaining their validity irrespective of temporal and spatial changes. Success in navigating through challenges is not solely contingent on the volume of knowledge acquired; instead, it significantly hinges on the methods of utilizing and applying this knowledge and navigating through the epoch characterized by the advent of the communication revolution and the proliferation of information technology. Hence, imparting thinking skills elevates the level of engagement and allure towards various experiences, thereby facilitating children in engaging in planning, observation, evaluation, inference, and deduction during the execution of activities or tasks.

Teaching competence is epitomized by the amalgamation of knowledge and experience that is evident in the teacher's behavior and is exhibited through professional conduct and patterns during their interaction with the components of the educational environment. One of the teacher's paramount roles is undertaking the evaluation process. This role is integral to the educational and learning process across its myriad dimensions. Furthermore, the evaluation process is instrumental in elevating the stature of the teaching profession and enhancing the capabilities of the professionals within, by facilitating the renewal of curricula, methodologies, and operational systems. This renewal allows those in supervisory and directive positions to guide and oversee the educational process more effectively. Consequently, it is essential for teachers to have a deep understanding of the fundamental concepts, principles, and competencies associated with the evaluation process. This understanding is crucial as it enables them to execute their responsibilities with efficacy and mastery, which is of paramount importance for the professional growth and development of the educators of tomorrow (Jalila & Al-Sassi, 2018; Al-Jasser & Al-Masoudi, 2018).

A myriad of studies have scrutinized the efficacy of the Jigsaw II strategy in fostering academic achievement in experimental groups. The research conducted by Al-Swaedah, Ismail, and Al-Swaedah (2021), Al-Kilani and Al-Muqusi (2019), Al-Mutlaq (2018), Sultan (2018), Al-Ghamdi (2017), Gambari (2016), and Al-Shamari (2018), evidenced statistically significant variations in the aggregate student scores. These variations are attributed to the employment of the Jigsaw strategy on both immediate and delayed achievement levels in social studies courses for high school students, with these variations consistently benefiting the experimental group. Concurrently, the study by Al-Tamran (2018) underscored the effectiveness of the Jigsaw strategy in cultivating sports communication skills amongst elementary school students. Furthermore, the research by Al-Salamat (2018) delineated the influence of utilizing the Jigsaw strategy in physics education on enhancing scientific acumen and perceived self-efficacy in first-grade high school students in Saudi Arabia. The outcomes of this study manifested statistically significant distinctions in favor of the experimental group.

Conversely, the research by Al-Qanou' (2017) exhibited statistically significant variances between the mean scores of students within the experimental and control groups pertaining to the application of mental habits tests, with the differences favoring the experimental group. This particular study advocated for the imperative integration of innovative and contemporary teaching methodologies into the instructional guide for teachers, inclusive of the Jigsaw strategy. In a related study by Karakop (2017), as cited in the research conducted by Al-Shamri (2020), the influence of the

Jigsaw strategy on the scholastic achievement of students engaged in science education, specifically within the realm of physics, was underscored. This was evidenced through an intensive training module involving 45 students, yielding favorable outcomes for those within the experimental faction. Additionally, the scholarly inquiry by Al-Badarin (2021) underscored the potent efficacy of cooperative learning applications in fostering the development of spelling and writing proficiencies amongst third-grade students enrolled in Arabic language courses in Jordan.

Through an examination of existing pedagogical literature and antecedent studies, the present research aligns with previous inquiries concerning the independent variable — the efficacy of the Jigsaw II strategy within the framework of cooperative learning. Preceding studies have extensively probed into its effectiveness across a spectrum of dependent variables, including academic achievement, immediate and deferred attainment, learning retention, social tolerance, cultivation of scientific acumen, self-efficacy, motivation, attitudinal shifts, and the enhancement of writing proficiencies in Arabic. These studies encapsulate a range of educational phases, extending from elementary and intermediate to secondary levels. Notably, there is a conspicuous absence of research exploring the strategy's potency in augmenting thinking skills or advancing cognitive evaluation competencies within the tertiary education landscape, specifically in faculties of education.

Hence, the idea for this research emerged to measure the effectiveness of the Jigsaw II strategy in developing thinking skills and fostering cognitive evaluation competencies among female students majoring in Child Education at Al-Balqa Applied University. This is an attempt to prepare students by equipping them with the necessary skills for the twenty-first century.

2. Statement of Problem

The genesis of the research problem can be traced back to the researcher's extensive experience in instructing numerous educational courses. This extensive experience has brought to light a noticeable decline in students' academic and cognitive achievement levels, alongside a marked deficiency in their cognitive evaluation competencies. There's also an observed weakness in students' execution of performance skills, which are pivotal in amplifying and organizing cognitive output. Students exhibited difficulties in assimilating a wide array of concepts such as classification, comparison, prediction, discerning relationships, hypothesis formulation, proposing solutions and alternatives, identifying similarities and differences, and perceptively analyzing data embedded within the presented problems. Additionally, challenges were noted in the application and integration of prior knowledge with new learning experiences, a process requiring a thorough understanding and accurate representation of the acquired knowledge.

This predicament is further exacerbated by predominant reliance on traditional educational methods characterized by lectures, rote learning, and mechanical memorization. These methods, often leading to information overload, primarily encourage the recall of information without fostering a deep understanding of the content. These teaching approaches, commonly employed by faculty members at both diploma and bachelor levels, unduly emphasize the passive reception of knowledge, neglecting the active, engaging, and critical learning processes essential for meaningful understanding and long-term retention of information. Such a scenario underscores the urgent need for reevaluating and potentially overhauling the current instructional methodologies to better align with the cognitive and academic needs of 21st-century students.

Furthermore, the current research problem is identified by the decline in cognitive evaluation competencies, as highlighted by the findings of various studies, including those conducted by Abu Zeid & Mohammed (2003), Al-Jahni (2011), Ozdemir (2013), Koloi (2016), Al-Ruwaili (2016), Al-Sanusi (2017), Ibrahim (2017), and Al-Kassi, Ibrahim, & Azzam (2020). The lack of exposure among students specializing in Child Education to modern teaching methods and techniques, such as the Jigsaw II strategy, which aligns with contemporary learning theories, has motivated the researcher to experiment with and implement this strategy. The intention is not solely to enhance students' acquisition of knowledge but also to imbue them with essential thinking skills, a fundamental

requirement for preparing future educators. Equipped with these skills, students will be adept at navigating various life situations, solving encountered problems, and applying their previous experiences and expertise effectively. These competencies are imperative for fostering a generation of educators who are not only knowledgeable but also resilient, innovative, and capable of addressing the challenges of the modern educational landscape.

One who observes the reality of kindergartens at the level of the Arab world would notice that the education level of its teachers is predominantly intermediate. Moreover, these teachers are not adequately scientifically and educationally qualified, especially in the domain of possessing cognitive and performance evaluation competencies (Kanaan, 2011). Therefore, this study attempts to answer the following questions:

1. Are there statistically significant differences at the significance level (α = 0.05) in the development of thinking skills among a sample of second-year students majoring in Early Childhood Education enrolled in the course "Play and Child Education," attributable to the Jigsaw II strategy?
2. Are there statistically significant differences at the significance level (α = 0.05) in the development of cognitive evaluation competencies among a sample of second-year students majoring in Early Childhood Education enrolled in the course "Play and Child Education," attributable to the Jigsaw II strategy?

3. Study Hypotheses

Hypothesis One: There are no statistically significant differences at the significance level (α = 0.05) in the development of thinking skills among a sample of second-year students majoring in Early Childhood Education, enrolled in the course "Play and Child Education," attributable to the Jigsaw II strategy.

Hypothesis Two: There are no statistically significant differences at the significance level (α = 0.05) in the development of cognitive evaluation competencies among a sample of second-year students majoring in Early Childhood Education, enrolled in the course "Play and Child Education," attributable to the Jigsaw II strategy.

4. Study Objectives

Examining the effectiveness of the Jigsaw II strategy in developing certain thinking skills among students majoring in Early Childhood Education at Al-Balqa Applied University in the course "Play and Child Education".

Investigating the effectiveness of the Jigsaw II strategy in fostering certain thinking skills for students enrolled in Early Childhood Education at Al-Balqa Applied University within the "Play and Child Education" course.

Identifying specific thinking skills and cognitive evaluation competencies intended to be developed in the "Play and Child Education" course for students majoring in Early Childhood Education.

5. Study Significance

The significance of this research, both theoretically and practically, is multifaceted. Firstly, it draws the attention of responsible entities, decision-makers, and those involved in developing, implementing, and evaluating early childhood plans and programs to the necessity of incorporating the Jigsaw II strategy into curriculum design, course plans, and teacher manuals. This incorporation aims at fostering and applying thinking skills and evaluation competencies, whether cognitive or performance-based.

Secondly, the research proposes a conceptual framework for assessing the quality of Early

Childhood Education student preparation programs in education colleges at both local and regional levels. The assessment begins with the program's general objectives and society's needs, covers teaching methods, faculty members, skills related to lower and higher-order thinking processes, and concludes with cognitive and performance evaluation competencies.

Thirdly, it directs attention towards the importance of developing evaluation competencies, considering them integral to the requirements of practical exercises in the educational field. Additionally, this study complements previous research efforts and opens avenues for further studies beneficial at various educational stages and in different courses.

Fourthly, the present research aims to identify the evaluation competencies among students majoring in Early Childhood Education. Possessing these competencies enhances and develops the teaching process.

Lastly, to the best of the researcher's knowledge, this research is among the few studies and inquiries that have examined the effectiveness of cooperative learning following the Jigsaw II strategy, measuring its impact on the development of thinking skills and evaluation competencies at the university level.

6. Terms of the Study and Their Operational Definitions

- **Effectiveness**: Refers to the extent of success achieved by implementing the Jigsaw II strategy on second-year students specializing in Early Childhood Education. This term encompasses the strategy's capability of instilling in these students both thinking skills and evaluation competencies.
- **Jigsaw II Strategy**: Defined as an organized set of learning and teaching procedures grounded on students' collaborative efforts within the classroom. The strategy engages students in two types of small groups: home groups and expert groups, each consisting of 5-6 students. Each expert group delves into a topic distinct from those examined by other groups. Subsequently, each student in the home group educates their peers on the topic they studied with their expert group.
- **Thinking Skills**: These are a set of skills identified by the current research as crucial for development and acquisition by students specializing in Early Childhood Education. These skills include classification, comparison, relationship identification, sequencing, and finally, productivity.
- **Classification Skill**: Refers to the student's ability to accurately categorize presented items based on specific criteria, measured by the score obtained in a thinking skills test.
- **Comparison Skill**: This skill allows the student to discern between presented items accurately based on specific characteristics, also measured by the score obtained in a thinking skills test.
- **Relationship Identification Skill**: Involves the student's capability to explore and ascertain the relationships between presented items or events, assessed by their score in a thinking skills test.
- **Sequencing Skill**: This skill enables the student to organize elements, stages, or terms in a predetermined, specific order of importance or size, as measured by the score obtained in a thinking skills test.
- Productivity: Refers to a student's ability to draw conclusions based on provided evidence or data, measured by the score obtained in a thinking skills test.
- **Competency**: This term denotes the minimum knowledge and skills required to be instilled in Early Childhood Education students at Al-Balqa` Applied University to effectively perform future teaching tasks.
- **Evaluation Competencies**: These are the abilities encompassing the requisite knowledge

needed to execute the teaching profession in the field of Early Childhood Education, particularly in the area of evaluation competencies. These are measured by the scores students obtain in the achievement test for the course "Play and Early Childhood Education".

- **Play and Early Childhood Education Course**: This mandatory course is part of the Early Childhood Education specialization requirements at Al-Balqa` Applied University. The course is endorsed by the university's planning committee and the admission and registration unit, bearing three accredited credit hours.

7. Study Limits and Limitations

- **Subject-Matter Limits**: The study is confined to specific cognitive elements: the Jigsaw II strategy, thinking skills, cognitive evaluation competencies, and the course "Play and Early Childhood Education". The experimental group was instructed within an applied framework focusing on two units: one addressing educational patterns and the role of educational games, and another exploring the types, forms, and educational significance of games, following the course plan and description with the goal of fostering thinking skills and cognitive evaluation competencies.
- **Human Limit**: The study exclusively targets a sample of students specializing in Early Childhood Education at Al-Balqa` Applied University.
- **Geographical Limit**: The research is conducted at the Faculty of Salt for Human Sciences, Department of Educational Sciences, located in Al-Salt, Jordan.
- **Temporal Limit**: The research process unfolds during the summer semester of the academic year 2022-2023.
- **Thinking Skills**: Five thinking skills are identified and focused upon within the study: classification, comparison, relationship identification, sequencing, and productivity.
- **Cognitive Evaluation Competencies**: Achievement pertaining to competencies is measured at various levels: recall, understanding and comprehension, and application. These dimensions provide a structured framework for assessing students' cognitive evaluation capacities, offering a nuanced understanding of their academic and intellectual development in the context of the targeted course and instructional strategy.

8. Methodology

8.1 Study Design

The researcher utilized an experimental method with a quasi-experimental design based on two groups, pre&post-measurement, to elucidate the impact of the independent variable - the cooperative learning strategy Jigsaw II - as opposed to conventional teaching methods on the dependent variable. The experimental group underwent a teaching process for the course "Play and Early Childhood Education," while the control group studied the same course using traditional methods. The study aimed to select questions that align with both the experimental and control groups for comparison purposes. This comparison was conducted between the results of the pre-test and post-test to determine the extent of the Jigsaw II strategy's effect on the dependent variables. This structured approach allows for a careful examination and analysis of the impact and effectiveness of the cooperative learning strategy in enhancing thinking skills and cognitive evaluation competencies amongst students enrolled in the specified course.

The Study design can be represented according to Table 1.

Table 1. The research design is quasi-experimental for both the experimental and control groups.

Group	Pre	Treatment	Post	Follow	Variable
) AG1 (Experimental	01 02	X	01 02	O1 O2	Thinking skills, cognitive assessment cmetencies
(BG1) Control	01 02	–	01 02		Traditional teaching

8.2 Study Sample

The research was executed on a sample comprising 65 students, selected from a total of 85 individuals enrolled in the "Play and Early Childhood Education" course for the summer term of the 2022-2023 academic year. These participants were meticulously chosen and organized into two distinctive groups. The experimental group encapsulated 33 students, who were engaged in a learning environment facilitated by the Jigsaw II strategy. Conversely, the control group, consisting of 32 students, experienced traditional pedagogical methods.

The selection of the sample was conducted with intentionality. This intentional selection is crucial, primarily due to the researcher's affiliation with Al-Balqa Applied University as a faculty member and, more specifically, as the instructor responsible for delivering the aforementioned course. Furthermore, the intentional selection was validated by the presence of an apt educational milieu that accommodated the division of students into two groups seamlessly. This strategic bifurcation was essential for creating an environment conducive to the successful deployment of the Jigsaw II strategy. The environmental readiness, coupled with the accessibility to indispensable tools and resources, provided a fertile ground for the Jigsaw II strategy to be implemented effectively, thus allowing for an accurate assessment of its impact and efficacy in comparison to conventional teaching methodologies within the confines of the course framework.

8.3 Study Groups' Equivalence

In a concerted effort to ensure parity between the experimental and control groups across all dependent variables—excluding the independent variable under investigation for its efficacy—the study meticulously controlled for dependent and extraneous variables that could potentially influence the course and outcomes of the experiment. To guarantee equivalence in the development of thinking skills and evaluation competencies between the two groups, a pre-test was administered before the implementation of the cooperative learning strategy Jigsaw II. This process involved referring to the students' cumulative grade point averages (GPAs) for the second semester of the 2022-2023 academic year. A T-Test was subsequently employed to identify any statistically significant differences between the students' averages at a significance level of 0.050.05. Table 2 elucidates these findings in greater detail.

This rigorous approach to ensuring equivalence was pivotal in isolating the impact of the Jigsaw II strategy, providing a robust framework for assessing its effectiveness in fostering the development of thinking skills and evaluation competencies amongst the participants. By creating a controlled environment where the only variable manipulated was the teaching strategy implemented, the study could accurately measure the contribution of the Jigsaw II technique to the students' academic development while controlling for other potential influencing factors.

Table 2. The T-Test was used to determine the differences between the scores of the study sample students (control and experimental) in the pre-test.

Group	N	M	SD	Final score	t	Sig
Experimental	33	33.01	7.70	70	0.258	0.280
Control	32	32.33	6.58			

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It is clear from Table (2) that the overall t value is 0.258, and the result confirms that it is not statistically significant at the significance level of (α = 0.05). Therefore, the two experimental members are considered equivalent in the tribal application, as it depends on the students' results at the university through the cumulative average in the second semester 2022/2023 as an indicator of parity and graduation between the two parts.

Teaching time was allocated in each of the experimental and control groups for an opportunity; The test specified for a fixed-duration program (8) weeks, two hours each week, for a total of (16) hours. During this experimental period, the topics identified in the two units were studied using the Jigsaw strategy, and the experimental group spent the same time experiencing these topics as the experimental group did.

8.4 Implementation steps of a lecture according to the cooperative learning strategy, Jigsaw

Students are divided into six original groups, each consisting of 5-6 members with heterogeneous academic achievement. A leader is appointed in each group. The lesson content is divided into five topics, approximately equal to the number of students in each group. Topics are then distributed to the original groups, with each student assigned a specific topic. Each group is given adequate time to read their assigned topic. Students with the same topic are then asked to gather to form expert groups. These expert groups exchange ideas about their assigned topics to comprehend, explain, and teach them to their peers in their original groups. After discussions in the expert groups, students return to their original groups where each student explains and teaches what they have learned to their peers, with encouragement for the rest of the group members to ask questions and engage in discussion. The teacher monitors the groups, moving between them and intervening when necessary, through the group leader, providing guidance on how to offer direction within the group. In the final stage, after the discussion process in the original groups is complete, the teacher selects a student from each group to present a summary of their topic until summaries of all topics have been presented and evaluated on an individual and group level.

9. Study Tools

An achievement test was prepared to measure thinking skills in five areas, as well as another achievement test to measure cognitive evaluation competencies in the course "Play and Child Education," by following the steps below:

9.1 Determining The Aim of the Test

The purpose of this test was to measure the cognitive aspect of the course "Play and Child Education" in the predetermined topics. This study is aimed at understanding the effectiveness of the Jigsaw II strategy in developing thinking skills and cognitive evaluation competencies among Female students specializing in Child Education, compared to the conventional method.

9.2 Content Analysis

The researcher analyzed the content of the two units in the course "Play and Child Education" by identifying terms, concepts, and generalizations included in the topics of the units. This was done to assist in preparing the objectives of the test and the levels of the questions. Analysis was conducted over time on a number of topics and after three weeks, the topics were re-analyzed. The Holsti equation was applied to calculate the reliability of the analysis, which reached a reliability of 91%.

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9.3 Preparing the Test Specification

The test specifications were determined based on the learning outcomes intended to be measured in students regarding thinking skills (classification, comparison, identifying relationships, ordering, productivity) and cognitive evaluation competencies according to Bloom's levels (knowledge, comprehension, application). The relative weight for the levels of objectives was also established.

9.4 Initial Test Preparation

The researcher constructed the initial form of the test, consisting of 41 multiple-choice questions addressing thinking skills and 43 multiple-choice questions for cognitive evaluation competencies. Each question had four equally-lengthed options, preventing students specializing in child education from guessing. Only one of the options was the correct answer, scored as one, while the others received a zero.

9.5 Formulating Test Items and Instructions Determining the Key to Correcting the Scale

The test items were formulated at various levels representing the questions and educational objectives intended to be achieved, with random answer distribution. The clarity of each question, its language, and its appropriateness to the students' level were taken into consideration. Each multiple-choice question had four options, and therefore, one mark was awarded for a correct answer, and zero for a wrong answer. Consequently, the final score for the thinking skills test was 35 marks, and the cognitive evaluation competencies also had a final score of 35 marks.

9.6 Psychometric Characteristics and Validity of the Achievement Test

Content validity of the test was established based on the opinions of expert judges specialized in curriculum, measurement, evaluation, and psychology. The weakest six items were deleted, and minor modifications were made to the thinking skills items, resulting in a final count of 35 questions distributed as follows: classification skill (6 items), comparison skill (7 items), relationship identifying skill (8 items), ordering skill (8 items), and productivity skill (6 items). Meanwhile, the weakest eight items of the evaluation competencies test were deleted, and some modifications were made to items number 13, 17, 21, 32, and 5, without affecting the test content. Thus, the final version of the test consisted of 35 items distributed as follows: 13 items for recall, 10 for understanding and comprehension, and 12 for application, as illustrated in Table3.

Table 3. Specifications for Thinking Skills Test and Cognitive Evaluation Competencies with Relative Weight

Skills	Classification	Comparison	Determining relations	Ordering	Productivity	Total
N	6	7	8	8	6	35
Percentage	%17	%20	%23	%23	%17	%100
Variable	Remember	Comprehension	Application			
N	13	10	12			35
Percentage	%37	%29	%34			%100

9.7 Preliminary Application of the Test:

This refers to the level of agreement between the results of two applications separated by two weeks on a survey sample different from the study sample, consisting of 20 students from the Childhood Education specialty. The objective of the survey sample was to determine the test duration, validate

the test, calculate its reliability, find the difficulty and discrimination coefficients for test items. The test was prepared electronically and presented within the university campus.

9.8 Test Reliability for Thinking Skills:

The reliability coefficient of the test was calculated using Cronbach's Alpha coefficient. The overall reliability coefficient for the scale was 0.84, while individual reliability coefficients ranged from 0.82 to 0.86, which are statistically acceptable values.

9.9 Test Reliability for Cognitive Evaluation Competencies:

The reliability coefficient of the test, using Cronbach's Alpha between the first and second applications, showed that the reliability coefficients ranged from 0.83 to 0.90. The overall reliability coefficient for the test was 0.86, which is a suitable correlation coefficient for research purposes.

9.10 Determination of Test Duration:

The students' test performance time was calculated by the average time it took for the first student to complete the test, which was 35 minutes, while the last student took 55 minutes. Therefore, the average of the two times was 45 minutes, which is the appropriate time to respond to the thinking skills test questions and 45 minutes for the cognitive evaluation competencies test.

9.11 Difficulty and Discrimination Coefficient for Thinking Skills:

These ranged between 0.29 and 0.69, meaning all difficulty and ease coefficients fell within the range that warrants keeping a question. The discrimination coefficients for thinking skills ranged from 0.20 to 1.00, indicating acceptable question discrimination coefficients.

9.12 Difficulty and Discrimination Coefficient for Cognitive Evaluation Competency Questions:

The difficulty and discrimination coefficients ranged between 0.25 and 0.79. Each question's discrimination coefficients ranged from 0.30 to 0.76, falling within the acceptable range for question discrimination coefficients."

10. Study Variables

Independent Variable: This is represented by the teaching method, with two levels: teaching through the Jigsaw II strategy, and traditional teaching methods.

Dependent Variable: In the current research, the dependent variable is represented by the development of thinking skills and cognitive evaluation competencies.

10.1 Statistical analysis

The means and standard deviations of the responses for both the experimental and control groups were calculated for the overall test of thinking skills and cognitive assessment competencies. An analysis of covariance (ANCOVA) was conducted to analyze the variance among the study participants' responses on the thinking skills test and cognitive assessment competencies test. Eta squared was used to measure the effect size of using the Jigsaw strategy in cooperative learning on the dependent variables.

11. Results

Hypothesis 1: There are no statistically significant differences at the (α = 0.05) level in the development of thinking skills among a sample of second-year students majoring in child education in the course "Play and Child Education" attributed to the Jigsaw II strategy.

To answer this hypothesis, the means and standard deviations of the students' responses in the control and experimental groups were calculated for the thinking skills test. Table 4 illustrates this.

Table 4. The arithmetic means and standard deviations of the students' responses in the study groups (control and experimental) on the test of thinking skills

Test	Gr	N	Pre-test		Post-test	
			M	SD	M	SD
Thinking Skills	Control	32	19.66	3.9	14.40	2.15
	Experimental	33	16.25	2.8	24.10	4.50

The results in Table 4 show that there are noticeable differences in the arithmetic means of students' responses on the thinking skills test. The arithmetic means of the experimental group, which was taught using the Jigsaw II strategy, are higher than the arithmetic means of the control group, which was taught using the conventional method.

To confirm the effect of using the teaching method with the Jigsaw II strategy on the thinking skills test for the study participants, the study conducted a one-way analysis of covariance (ONE WAY ANCOVA) for students' responses on the pre-test and post-test of overall thinking skills for the two study groups (control and experimental), according to the teaching method. The results of this analysis are shown in Table 5:

Table 5. The results of the one-way analysis of covariance (ANCOVA) for the responses of the study participants on the test of thinking skills

Source of variation	Sum of squares	df	Mean sqares	F	Sg	Eta squared
Teaching method	1452.732	1	1452.732	124.776	0.000*	0.672
Pre-test	60.230	1	60.230	5.173	0.026	0.078
Error	710.208	62	11.643			
Total	25988.000	65				

The results shown in Table 5 indicate that the value of (F) for the teaching method used in teaching the experimental study group was 124.776, with a significance level of (0.000). This is statistically significant at (α = 0.05), suggesting the presence of statistically significant differences in students' responses on the thinking skills test attributed to the teaching method, in favor of the experimental group. The effect size was large, reaching a value of 0.672 indicating the effectiveness of the teaching method used in teaching the control group. This leads to the rejection of the null hypothesis and the acceptance of the alternative hypothesis, meaning that there are statistically significant differences between the mean scores of the students in the control group and the experimental group in the post-test, in favor of the experimental group, and that the differences between the two groups are substantial.

This confirms the effectiveness of the Jigsaw 2 strategy in developing thinking skills among female students majoring in child education at Al-Balqa Applied University in the "Play and Child Education" course. These results can be interpreted as the strategy's clear impact in building positive interactive relationships among students themselves and between the course instructor, promoting cooperation and camaraderie among learning groups. This positive atmosphere reflects on their performance. The more students are engaged, the better their performance and faster their skill

acquisition.

The classroom environment free from constraints, rigidity, and pressure leads to better skill acquisition and task performance. The success of the experimental group can be attributed to the application of the strategy, which creates a stimulating educational environment centered around students. It empowers them to access information independently, engage more in the lesson, ask questions, and utilize various skills such as classification, comparison, establishing relationships, sequencing, and reaching conclusions.

Moreover, this strategy instills a sense of joy and eagerness for learning, allowing students to overcome their fear of understanding complex subjects. This indicates that the instructor presented the topics in an attractive and enjoyable manner, which had a positive impact on the students' skill acquisition, resulting in higher achievement in the thinking skills test.

The researcher believes that the student's perception of having a positive and effective role during the cooperative learning situation, as well as her sense of efficacy and ability to contribute more and express her opinions, are among the most important factors that develop her thinking skills. This increases the flexibility of learning in accepting and objectively critiquing different perspectives. It also instills in her a sense of self-respect and respect for others, while also equipping her with more cooperative behaviors and skills.

Within this cooperative learning context, enthusiasm and high competition among groups to achieve success and excellence foster the student's realization that learning through the Jigsaw II method in cooperative learning is enjoyable, engaging, and fulfills her psychological, social, and cognitive needs.

These findings align with the results of several studies that have demonstrated the effectiveness of the Jigsaw II strategy in teaching. Some of these studies include those conducted by Al-Sawaida, Ismail, and Al-Sawaida (2021), Al-Kilani and Al-Muqassi (2019), Al-Matlaq (2018), Al-Ghamdi (2017), Gambari (2016), Al-Shammari (2018), Al-Tamran (2018), and Al-Salamat (2018).

On the other hand, the study conducted by Al-Qanou' in 2017 revealed statistically significant differences between the average scores of students in the experimental and control groups in the application of the test of thinking habits, favoring the experimental group.

The second hypothesis stated: "There are no statistically significant differences at a significance level of (α = 0.05) in the development of cognitive assessment competencies among a sample of second-year students majoring in child education in the course (Play and Child Education) attributed to the Jigsaw II strategy." To answer this hypothesis, the study calculated the means and standard deviations for the responses of the students in both the control and experimental groups on the test of cognitive assessment competencies. Table 6 illustrates these results.

Table 6. The arithmetic means and standard deviations of students' responses in the control and experimental groups on the test of cognitive assessment development as a whole

Test	Group	N	Pre-test		Post-test	
			M	SD	M	SD
Cognitive assessment competencies	Control	32	15.70	2.30	15.5	4.8
	Experimental	33	16.75	4.34	28.9	4.6

The results in Table (6) show that there are significant differences in the mean scores of students' responses on the cognitive assessment development test. The mean scores of the experimental group, which was taught using the Jigsaw II strategy, are higher than the mean scores of the control group, which was taught using the traditional method.

To verify the effect of teaching using the Jigsaw II strategy on the cognitive assessment development test among the study sample, the study conducted a one-way ANCOVA analysis of students' responses on the pre-test and post-test of cognitive assessment development for both groups (control and experimental), according to the teaching method. The results of this analysis are presented in Table (7).

Table 7. Results of the one-way analysis of covariance (ANCOVA) for the responses of the study participants on the cognitive assessment development test.

Source of variation	Sum of squares	df	Mean squares	F	Sig	Eta squared
Teaching method	2928.618	1	2928.618	135.755	0.000*	0.690
Pre-test	53.906	1	53.906	2.499	0.119	0.039
Error	1315.938	62	21.573			
Total	35885.000	65				

The results presented in Table (7) indicate that the value of (F) for the teaching method used in teaching the experimental study group was (135.755), with a significance level of (0.000), which is statistically significant at (α = 0.05). This suggests the presence of statistically significant differences in the students' responses on the cognitive assessment development test attributed to the teaching method, in favor of the experimental group. The effect size was large, with a value of (0.690), indicating the effectiveness of the teaching method used in teaching the control group. This leads to rejecting the null hypothesis and accepting the alternative hypothesis, which means there are statistically significant differences between the average scores of the students in the control group and the experimental group in the post-assessment, in favor of the experimental group, and the differences between the two groups are substantial.

These results can be interpreted as follows: Jigsaw II strategy takes into account individual differences since the groups are heterogeneous, and it directs the students' attention towards cognitive assessment competencies in the teaching process. It emphasizes the active role of students in learning and the utilization of lower-level cognitive assessment competencies that require a review of all the concepts, knowledge, and skills acquired during the planning and execution of tasks assigned to each group.

Furthermore, the strategy provides students with adequate opportunities to practice and apply cognitive assessment competencies, allowing them to organize, arrange, evaluate, and connect knowledge with concepts and facts. This enables students to build mental representations of the content in the form of cognitive assessment competencies at various cognitive levels (recall, comprehension, and application).

Moreover, the strategy used in this research facilitates group communication and collaboration among students to achieve cognitive assessment competencies relevant to their teaching behaviors during the planning and execution of tasks assigned to them. This is adapted to the number of students in each group, the lesson duration, and the educational resources intended for use in the lesson. It allows students to engage in active cognitive processes to explore cognitive assessment competencies more deeply. This underscores the strategy's positivity and effectiveness in developing cognitive assessment competencies.

12. Discussion

The study's findings provide valuable insights into the effectiveness of the Jigsaw II strategy in enhancing the thinking skills of second-year students majoring in child education. There was a discernible improvement in the thinking skills of the students who were part of the experimental group, indicating the noteworthy efficacy of this teaching method.

The outcomes of the Jigsaw II strategy in the study are consistent with previous research findings. For instance, several studies like those by Al-Sawaida et al. (2021), Al-Kilani & Al-Muqassi (2019), Al-Matlaq (2018), Al-Ghamdi (2017), and Gambari (2016), highlighted the effectiveness of this strategy in the learning process. These studies corroborate the current research findings, indicating a broader consensus in the academic community regarding the strategy's impact on student learning.

The positive interactive relationships that the Jigsaw II strategy fosters among students, and between students and instructors, seem to play a pivotal role in its success. The strategy not only

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promotes cooperation and camaraderie among learning groups but also creates a stimulating educational environment. This environment, centered around students, empowers them to access information autonomously, actively engage in lessons, ask questions, and apply various thinking skills such as classification, comparison, and establishing relationships. All these factors together contribute to creating a dynamic learning atmosphere where students feel motivated and engaged.

Furthermore, the Jigsaw II strategy has been observed to instill a sense of joy and enthusiasm for learning within students. This is crucial for overcoming fears associated with understanding complex subjects. The strategy aids instructors in delivering topics in a manner that is both engaging and enjoyable for students, thereby positively influencing skill acquisition and achievement levels.

Moreover, the effectiveness of the Jigsaw II strategy in cognitive assessment competencies development is evident from the findings. The strategy effectively caters to individual differences among students, enhancing focus and active student participation in cognitive assessment competencies during the teaching process. This proactive involvement is crucial for reviewing and understanding all the concepts, knowledge, and skills acquired during the planning and execution of assigned tasks.

Through the Jigsaw II strategy, students get ample opportunities to practice and apply cognitive assessment competencies. This practice allows them to organize, evaluate, and connect knowledge with facts and concepts, facilitating the development of cognitive assessment competencies at various levels, including recall, comprehension, and application. This, in turn, helps students build mental representations of content, deepening their understanding and application of cognitive assessment competencies.

The collaborative aspect of the Jigsaw II strategy also enhances communication among students, fostering a sense of shared responsibility and community within the learning environment. This not only makes the learning process more engaging for students but also contributes positively to the development of cognitive assessment competencies, providing a holistic approach to learning and assessment.

To sum up, the findings from the study and the supporting literature collectively suggest that the Jigsaw II strategy is an effective tool for fostering thinking skills and cognitive assessment competencies among students in child education courses. This teaching strategy, with its focus on collaboration and active student participation, provides a dynamic and engaging learning environment that supports the holistic development of students' cognitive skills. For educators looking to enhance the learning experience and outcomes for their students, incorporating the Jigsaw II strategy into their teaching practices might be a valuable approach. Future studies may continue to explore the long-term impacts and effectiveness of this strategy across various subjects and educational levels to further validate and understand its potential benefits in the educational landscape.

13. Conclusion

In conclusion, the study highlights the significant effectiveness of the cooperative learning-based teaching strategy, Jigsaw II, in enhancing the overall thinking skills of students majoring in Child Education at Al-Balqa Applied University, particularly in the context of the Play and Child Education course. Furthermore, it demonstrates the strategy's substantial impact on developing cognitive assessment competencies across various levels, including recall, comprehension, and application.

14. Recommendations

Building on these findings.recommendations emerge. Firstly, faculty members are encouraged to adopt the Jigsaw II strategy in their lectures to foster independent knowledge acquisition and utilization among students. Secondly, the incorporation of the Jigsaw II strategy into curricula and course plans is proposed, presented in an engaging manner to kindle students' enthusiasm for

learning, teaching, and training. Thirdly, universities should provide the necessary infrastructure for the successful implementation of the Jigsaw II strategy. Fourthly, training courses should be organized to equip Child Education students with the skills to use the Jigsaw II strategy effectively during their field training. Lastly, the study underscores the importance of focusing on both lower-level and higher-level cognitive assessment competencies through modern teaching strategies, emphasizing the need for further experimental research in various university faculties to explore the strategy's impact on additional variables.

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