

Keyword Network Analysis of Research Articles in the *Asia-Pacific Journal of Research in Early Childhood Education*: Research Trends From 2007 to 2021

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Abstract

This study aimed to explore changes in research articles published in the *Asia-Pacific Journal of Research in Early Childhood Education* (APJRECE) over time. To that end, keyword network analysis was conducted on a total of 244 research articles published in the journal during the 15-year period (both overall and in 5-year increments) from 2007 to 2021. The following results were obtained: first, discussions on common, important topics in early childhood education were held continuously and changes in keyword trends were observable within each of the different 5-year periods. Second, although APJRECE articles initially focused on qualitative studies, a balance of quantitative and qualitative research with some mixed-method papers and literature reviews was eventually attained. Third, an analysis of APJRECE articles by region revealed that the journal included studies from diverse locations, including East Asia, Southeast Asia, Oceania, North America, Africa, Europe, and the Middle East. These results confirm that APJRECE functions well as an international journal and that it provides a platform for academic exchange. Additionally, the results indicate that it has addressed and considered a wide range of topics and issues in early childhood education over time.

Keywords : *Asia-Pacific Journal of Research in Early Childhood Education*, APJRECE, research trends, keyword network analysis

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Introduction

The Pacific Early Childhood Education Research Association (PECERA) was established in 2000 to improve the quality of early childhood-related studies in the Asia Pacific and to facilitate exchanges among early childhood education researchers. PECERA members currently include Australia, China, the Hong Kong Special Administrative Region of the People's Republic of China, Indonesia, Japan, Korea, New Zealand, the Philippines, Singapore, Taiwan, Thailand, and Malaysia (PECERA, April 1, 2022). Other countries also participate actively with PECERA in academic exchanges for the development of early childhood education through international academic conferences, academic journals published by PECERA, and the Young Scholar Awards program.

PECERA publishes the *Asia-Pacific Journal of Research in Early Childhood Education* (APJRECE) to foster a worldwide network of early childhood education researchers and to provide them with academic research and information. APJRECE was first published in 2007 and, since 2013, is published three times annually. As of 2022 it has produced 40 volumes. Furthermore, APJRECE has been selected for indexing on SCOPUS every year since 2018, and it continues to provide high-quality academic research on early childhood education (PECERA KOREA, April 1, 2022).

A journal is the product of the theories and practical interests of the academic field; as such, it also serves as a historical record of the directional shifts in theory and methodology, and of changing academic interests (Kim, Choi, & Chung, 2017). Accordingly, examining research trends among APJRECE articles helps us understand how academic interest in early childhood education has changed and developed over time in the Asia Pacific. This article itself could thus serve as a reference for expanding the scope of research topics in APJRECE.

Recently, researchers have applied the keyword network analysis method to the comprehensive analysis of trends in academic research. Keyword network analysis focuses on which other keywords appear in proximity to a given keyword; this theory offers the advantage of revealing semantic association among keywords (Choi & Park, 2011). That is, a comprehensive examination of research trends in a given academic field can be conducted by determining the frequency of appearance of specific keywords that represent major concepts, while also analyzing their associations with other peripheral keywords (Park et al.,

2021; Scott & Carrington, 2011).

In this study, keywords are the words that an author selects and publishes along with their research articles. They represent, for example, a study's purpose or topic and can therefore serve as useful categories for identifying similarities and differences among articles. Keyword network analysis can be effective in identifying major research topics and overall research characteristics in a discipline (Kim, Choi, & Chung, 2017; Kim & Yu, 2013). Keywords identified as high frequency likely represent a field's most significant topics. Accordingly, keyword network analysis is appropriate for analyzing overall research trends across APJRECE.

This study's purpose is to identify how publications on early childhood education have transformed historically over the 15-year period between 2007 and 2021. By applying the methodology of keyword network analysis to APJRECE, this paper identifies which issues have been considered important in early childhood education in the Asia Pacific. It also analyzes how such issues have trended over the past 15 years and how they are associated with one another. In this way, this study comprehensively analyzes research trends and characteristics among APJRECE articles, explores both the past and the present of early childhood education in the Asia Pacific, and describes the findings' implications. Finally, this paper offers future research directions and topics.

Methods

Data Collection

A library discovery search was conducted to identify articles on early childhood education. The inquiry included Volume 1, No. 1 from 2007 (APJRECE's first issue) to Volume 15, No. 3 in 2021, thus spanning a 15-year period. A total of 244 research articles were identified; the raw data collected included APJRECE volume numbers, article titles, author names, subjects, keywords, and abstracts. Only research articles were included in the study data; non-academic articles, such as Guest Editor's Introduction, were excluded.

Data Analysis and Procedure

After the initial data collection, content analysis was performed to determine which methodology was used in the selected studies, thereby analyzing the trends. The following research methodological categories, which had already been established in previous papers (Choi & Kim, 2012; Lee, Kim, & Kim 2018; Lee, Kwak, & Kang, 2018), were applied: quantitative, qualitative, the literature review, mixed-method, and others. Three researchers specializing in early childhood education conducted content analysis by establishing the analysis criteria and checking consistency. Frequency analysis was performed to identify the methodologies being used and in what proportions.

Furthermore, to examine regional trends in the journal, which publishes international studies, the researchers read the articles and noted the country in which the research had been conducted. The articles were then categorized by the following regions: Southeast Asia, East Asia, Oceania, North America, Europe, and Africa. The articles with two or more subjects were classified as other countries. The three articles from the Middle East were excluded from the analysis because the number of articles was disproportionate to that from other regions.

To analyze research topics, keyword network analysis was conducted on the keywords published by the authors along with their articles. Network analysis provides a visual representation of a dataset as a network of nodes and links; it also identifies the characteristics that shape it. What is more, network analysis can explain a network's characteristics through the relationships or behaviors among the network's individual units (Kim & Kim, 2016; Scott & Carrington, 2011). It is a useful methodology when dealing with voluminous data or when a visual overview of the data is needed. As such, it is particularly suitable for analyzing the keywords of numerous research articles.

Given that texts constitute the main data in this study, the keyword network analysis technique was applied; keywords were therefore collected for the network analysis and entered in the Netminer software program (Netminer, 2022). After determining the number of times each unique word appeared in the overall data, data cleaning was then conducted. For instance, words with similar meanings, such as *teacher* and *teachers*, were consolidated. Because the program is case sensitive and views *Child* and *child* (for example) as two

different words, all keywords were input into the software in their lowercase form.

To generate the co-occurrence matrix, which is a critical stage in network analysis, the keyword data were converted into a one-mode network. For example, if the keywords *child*, *teacher*, and *parent* were published as part of a research article, the words would be paired as *child-teacher*, *teacher-parent*, and *child-parent* in the co-occurrence matrix.

After performing data cleaning and co-occurrence matrix generation, unique word frequency, rank, degree centrality, and betweenness centrality were obtained. Given that frequency and centrality are used to gauge the keyword importance in keyword network analysis, this study examined which keywords were presented as important and which mediated relationships with other words with strong betweenness centrality. Word clouds were also generated from the overall data; frequency, degree centrality, and betweenness centrality were also calculated (Lee, Kim, & Kim, 2018; Park et al., 2021).

To capture the historical trends, 15 years of data were divided into three 5-year periods: 2007 to 2011, 2012 to 2016, and 2017 to 2021. Then, network analysis was conducted on the keywords for articles published during each of the different periods. Because *child* and *education* were connected to many of the 442 unique keywords that accompanied the 244 journal articles analyzed, it became difficult to identify less visible trends; therefore, these words were excluded from the overall network analysis.

Results

Keyword Network Analysis Results

Taking frequency, degree centrality, and betweenness centrality into account, the keywords *child*, *teacher*, *education*, *kindergarten*, *parent*, *development*, *curriculum*, and *policy* often accompanied studies on early childhood education. They also represented common topics.



Figure 1. Word cloud of keywords from research articles from 2007 to 2021

Table 1. *The ranking of keywords* in research articles from 2007 to 2021 by frequency, degree centrality, and betweenness centrality*

Rank	Frequency		Degree centrality		Betweenness centrality	
1	child	131	Child	0.321101	child	0.293681
2	education	86	Teacher	0.293578	teacher	0.206078
3	teacher	61	Education	0.238532	education	0.177149
4	kindergarten	53	Kindergarten	0.238532	kindergarten	0.169211
5	development	21	Parent	0.110092	parent	0.072029
6	curriculum	21	Policy	0.110092	language	0.03982
7	parent	18	Language	0.100917	policy	0.039731
8	language	15	Curriculum	0.082569	book	0.036728
9	school	14	Science	0.073394	curriculum	0.034546
10	play	14	Skill	0.073394	mathematics	0.031202
11	mathematics	14	Development	0.064220	relationship	0.029252
12	policy	13	Learning	0.064220	learning	0.029221
13	learning	13	Mathematics	0.064220	perception	0.022379
14	science	12	Perception	0.064220	school	0.022035
15	practice	12	School	0.064220	family	0.020636

* Keywords with a frequency ≤ 11 were excluded.

Historical Trend Analysis Results

Table 2 shows the historical trends of research articles in APJRECE across the three different 5-year periods. The 2017–2021 period saw the most activity, with 103 research articles on childhood education (42.21%) being published. The 2012–2016 period followed with 80 articles (32.79%), whereas the 2007–2011 period accounted for 61 papers (25%). The number of scholarly articles published per each 5-year period increased from Period 1 to Period 3.

Table 2. *The publication frequency of research articles, per each 5-year period*

Category	Total	2007–2011	2012–2016	2017–2021
<i>N (%)</i>	244 (100)	61 (25.00)	80 (32.79)	103 (42.21)

Because all the academic studies that APJRECE publishes relate to early childhood education, *child* and *education* were keywords in most studies; as such, they were excluded from network keyword analysis by period.

Period 1: 2007–2011

Figure 2 and Table 3 show the keyword network analysis results of 61 research articles from 2007 to 2011. After *child* and *education*, *teacher* and *kindergarten* were found to be the most important, followed by *language*, *curriculum*, *diversity*, and *science*.

Period 2: 2012–2016

Figure 3 and Table 4 show the keyword network analysis results of the 80 research papers that APJRECE published between 2012 and 2016. After *child* and *education*, *kindergarten* and *teacher* were identified as the most central, followed by *parent*, *mathematics*, *skill*, *development*, *play*, and *technology*. Compared to Period 1, more studies on *parents* and *family* were conducted; additionally, papers focusing on new themes, such as *play* and *technology*, began to emerge.



Figure 2. Network map of keywords in research articles from 2007

Table 3. *The ranking of keywords* in research articles from 2007 to 2011 by frequency, degree centrality, and betweenness centrality*

Rank	Frequency		Degree centrality		Betweenness centrality	
1	teacher	26	teacher	0.201754	teacher	0.172618
2	kindergarten	16	kindergarten	0.114035	kindergarten	0.119676
3	science	8	curriculum	0.043860	language	0.055426
4	curriculum	8	language	0.043860	curriculum	0.025151
5	policy	6	relationship	0.043860	diversity	0.024996
6	relationship	5	communication	0.035088	science	0.024996
7	language	4	infant	0.035088	kindergarten child	0.024686
8	school	3	policy	0.035088	policy	0.01951
9	practice	3	science	0.035088	care	0.016768
10	knowledge	3	diversity	0.026316	day	0.016768
11	intervention	3	gender	0.026316	relationship	0.012731
12	inquiry	3	knowledge	0.026316	knowledge	0.011489
13	concept	3	access	0.017544	communication	0.009005
14	activity	3	attitude	0.017544	access	0.008539

* Keywords with a frequency ≤ 2 were excluded.



Figure 3. Network map of keywords in research articles from 2012 to 2016

Table 4. The ranking of keywords* in research articles from 2012 to 2016 by frequency, degree centrality, and betweenness centrality

Rank	Frequency	Degree centrality	Betweenness centrality
1	kindergarten 16	kindergarten 0.094675	kindergarten 0.227828
2	teacher 13	teacher 0.082840	teacher 0.190432
3	parent 9	parent 0.053254	technology 0.145663
4	mathematics 8	mathematics 0.041420	medium 0.130565
5	skill 7	skill 0.041420	mathematics 0.129250
6	development 7	games 0.035503	skill 0.083150
7	play 6	number 0.035503	science 0.077873
8	narrative 6	family 0.029586	approach 0.067948
9	language 6	approach 0.023669	parent 0.064491
10	experience 6	development 0.023669	policy 0.053311
11	practice 5	language 0.023669	language 0.051282
12	curriculum 5	policy 0.023669	number 0.047866
13	number 4	value 0.023669	knowledge 0.045554
14	literacy 4	assessment 0.017751	development 0.039459
15	games 4	experience 0.017751	family 0.037147
16	family 4	involvement 0.017751	value 0.036971

* Keywords with a frequency ≤ 3 were excluded.

Period 3: 2017–2021

Figure 4 and Table 5 show the keyword network analysis results for APJRECE's 103 research articles between 2017 and 2021. After *child* and *education*, *teacher* and *kindergarten* were the most prominent, followed by *development*, *play*, *learning*, *music*, *parent*, and *time*. Studies on *learning*, *play*, *time*, and *picture book* occurred more frequently than in the previous two periods.

Frequency of Methodologies used in APJRECE Research Articles

Table 6 reports the frequency at which the various types of methodologies were used in APJRECE articles. For the 244 studies published between 2007 and 2021, qualitative studies accounted for 41.39%, followed by quantitative studies (29.92%), then mixed-method studies



Figure 4. Network map of keywords in research articles from 2017 to 2021

Table 5. *The ranking of keywords* in research articles from 2017 to 2021 by frequency, degree centrality, and betweenness centrality*

Rank	Frequency		Degree centrality		Betweenness centrality	
1	teacher	22	kindergarten	0.095694	kindergarten	0.26613
2	kindergarten	21	teacher	0.076555	teacher	0.256379
3	development	12	development	0.038278	play	0.09696
4	school	10	music	0.038278	development	0.080944
5	learning	10	parent	0.038278	music	0.074252
6	parent	9	center	0.028708	learning	0.061652
7	music	8	curriculum	0.028708	time	0.049873
8	curriculum	8	perception	0.028708	childcare	0.046375
9	play	7	school	0.028708	learner	0.044185
10	time	5	time	0.028708	resilience	0.043586
11	quality	5	language	0.023923	parent	0.043046
12	language	5	learning	0.023923	problem	0.042114
13	book	5	ministry	0.023923	picture book	0.040629
14	assessment	5	play	0.023923	ministry	0.040555

* Keywords with a frequency ≤ 4 were excluded.

Table 6. *Frequency analysis by research method*

Category	Total	2007–2011	2012–2016	2017–2021
Quantitative studies	73 (29.92)	17 (27.87)	19 (23.75)	37 (35.92)
Qualitative studies	101 (41.39)	33 (54.10)	29 (36.25)	39 (37.86)
Literature reviews	32 (13.11)	7 (11.48)	15 (18.75)	10 (9.71)
Mixed-methods studies	36 (14.75)	2 (3.28)	17 (21.25)	17 (16.50)
Others	2 (0.82)	2 (3.28)	0 (0.00)	0 (0.00)
Sum	244 (100)	61 (100)	80 (100)	103(100)

(14.75%), literature reviews (13.11%), and others (0.82%). While qualitative research accounted for 54.10% in Period 1, qualitative and quantitative studies became more evenly distributed and mixed-method papers began to emerge.

Quantitative Studies

Table 7 exhibits the results of the keyword network analysis conducted on the quantitative studies. *Teacher*, *kindergarten*, and *parent* were identified as the most important. *Practice*, *perception*, *interaction*, *function*, *efficacy*, *behavior*, *attitude*, and *ability* also ranked quite high, indicating that they are frequent in quantitative research.

Table 7. *The ranking of keywords* from quantitative study articles by frequency, degree centrality, and betweenness centrality*

Rank	Frequency		Degree centrality		Betweenness centrality	
1	teacher	22	teacher	0.128655	teacher	0.355510
2	kindergarten	16	kindergarten	0.087719	kindergarten	0.178670
3	parent	11	parent	0.052632	school	0.126453
4	school	10	mathematics	0.040936	efficacy	0.096164
5	mathematics	8	music	0.035088	parent	0.090386
6	development	6	efficacy	0.029240	mathematics	0.090112
7	skill	5	number	0.029240	skill	0.065729
8	practice	5	school	0.029240	music	0.055659
9	learning	5	word	0.029240	function	0.054833
10	problem	4	attachment	0.023392	bullying	0.049811
11	perception	4	attitude	0.023392	picture book	0.047403
12	music	4	behavior	0.023392	kindergarten child	0.044892
13	interaction	4	bullying	0.023392	development	0.039869
14	function	4	experience	0.023392	language	0.039835
15	experience	4	perception	0.023392	care	0.037840
16	efficacy	4	practice	0.023392	learning	0.037672
17	book	4	problem	0.023392	book	0.032198
18	behavior	4	skill	0.023392	center	0.032129
19	attitude	4	awareness	0.017544	word	0.032115
20	ability	4	book	0.017544	number	0.031635

* Keywords with a frequency ≤ 3 were excluded.

Qualitative Studies

Table 8 exhibits the keyword network analysis results of the qualitative study articles. *Teacher*, *kindergarten*, and *parent* were found to be important. *Relationship*, *interaction*, *coaching*, *approach*, and *training* ranked high, which suggests their centrality to qualitative research.

Table 8. *The ranking of keywords* from qualitative study articles by frequency, degree centrality, and betweenness centrality*

Rank	Frequency*		Degree centrality		Betweenness centrality	
1	teacher	26	teacher	0.095506	teacher	0.259529
2	kindergarten	21	kindergarten	0.084270	picture book	0.203570
3	curriculum	14	curriculum	0.044944	relationship	0.201232
4	science	9	language	0.039326	kindergarten	0.174302
5	policy	8	approach	0.033708	mathematics	0.157240
6	development	8	development	0.033708	number	0.155526
7	relationship	6	policy	0.033708	language	0.146736
8	language	6	relationship	0.033708	book	0.127163
9	play	4	science	0.028090	technology	0.119977
10	mathematics	4	skill	0.028090	interaction	0.118898
11	coaching	4	interaction	0.022472	training	0.089172
12	approach	4	mathematics	0.022472	course	0.078184

* Keywords with a frequency ≤ 3 were excluded.

Literature Reviews

Table 9 exhibits the keyword network analysis results for literature reviews. *Kindergarten*, *ministry*, *curriculum*, *culture*, *childcare*, and *thinking* were identified as the most important. *Globalization*, *empathy*, *diversity*, and *disability* were more noticeable compared to other research methods. Notably, *teacher* was not listed as a keyword in any of the literature reviews.

Mixed-Method Studies

Table 10 exhibits the keyword network analysis results of mixed-method research articles.

Table 9. *The ranking of keywords* from literature reviews by frequency, degree centrality, and betweenness centrality*

Rank	Frequency		Degree centrality		Betweenness centrality	
1	kindergarten	5	kindergarten	0.100000	kindergarten	0.047785
2	curriculum	5	ministry	0.062500	ministry	0.030222
3	development	4	curriculum	0.050000	childcare	0.028797
4	culture	4	culture	0.037500	curriculum	0.021835
5	thinking	3	diversity	0.037500	thinking	0.015823
6	play	3	globalization	0.037500	culture	0.014873
7	ministry	3	school	0.037500	ADHD	0.011392
8	learning	3	thinking	0.037500	collaboration	0.009494
9	language	3	ADHD	0.025000	intersubjectivity	0.009494

* Keywords with a frequency ≤ 2 were excluded.

Table 10. *The ranking of keywords* from mixed-method studies by frequency, degree centrality, and betweenness centrality*

Rank	Frequency		Degree centrality		Betweenness centrality	
1	teacher	13	Kindergarten	0.142857	kindergarten	0.236272
2	kindergarten	11	teacher	0.129870	teacher	0.182103
3	music	5	games	0.051948	measurement	0.064935
4	play	4	parent	0.051948	length	0.053315
5	practice	3	sound	0.051948	parent	0.042208
6	learning	3	learner	0.038961	learner	0.041695
7	learner	3	music	0.038961	linear	0.041012
8	language	3	play	0.038961	comparison	0.028025
9	development	3	activity	0.025974	day	0.028025
10	assessment	3	analysis	0.025974	role	0.028025
11	activity	3	approach	0.025974	music	0.025803
12	ability	3	assessment	0.025974	play	0.021189

* Keywords with a frequency ≤ 2 were excluded.

Teacher, *kindergarten*, and *parent* were found to be important; additionally, *music*, *play*, *sound*, and *comparison* were common topics in mixed-method studies.

Results of the Analysis of APJRECE Research Articles by Region

Table 11 exhibits the results from analyzing APJRECE articles by region. From 2007 to 2021 the greatest proportion of the 244 studies (43.44%) was from East Asia, followed by Southeast Asia (20.49%), Oceania (11.48%), North America (11.48%), Africa (4.10%), Europe (4.10%), others (3.69%), and the Middle East (1.23%). During Period 1 (2007–2011), most studies originated from East Asia (63.93%) and Southeast Asia (13.11%). During Period 2 (2012–2016), the percentages of articles from North America (18.75%) and Oceania (18.75%) increased. As for Period 3 (2017–2021), studies either related to or conducted in Africa and the Middle East appeared, suggesting that APJRECE is diversifying in terms of broadening its coverage of geographical regions. Furthermore, studies comparing different regions have also been conducted, although they were few and far between.

Table 11. *Frequency analysis by region*

Category	Total	2007–2011	2012–2016	2017–2021
Africa	10 (4.10)	1 (1.64)	1 (1.25)	8 (7.77)
East Asia	106 (43.44)	39 (63.93)	31 (38.75)	36 (34.95)
Europe	10 (4.10)	1 (1.64)	4 (5.00)	5 (4.85)
North America	28 (11.48)	6 (9.84)	15 (18.75)	7 (6.80)
Oceania	28 (11.48)	3 (4.92)	15 (18.75)	10 (9.71)
Southeast Asia	50 (20.49)	8 (13.11)	11 (13.75)	31 (30.10)
Middle East	3 (1.23)	0 (0.00)	0 (0.00)	3 (2.91)
Others	9 (3.69)	3 (4.92)	3 (3.00)	3 (2.91)
Sum	244 (100)	61 (100)	81 (100)	(100)

Africa

Table 12 reports the keyword network analysis results of research articles from Africa (Botswana, Ghana, Nigeria, South Africa, and Kenya). *Teacher*, *parent*, *policy*, and *learning*

were found to be important, and topics including *therapist*, *attachment*, and *efficacy* were trending in such research.

Table 12. *The ranking of keywords* in research articles from Africa by frequency, degree centrality, and betweenness centrality*

Rank	Frequency		Degree centrality		Betweenness centrality	
1	teacher	5	teacher	0.200000	teacher	0.142529
2	policy	2	parent	0.100000	parent	0.068966
3	parent	2	attachment	0.066667	learner	0.050575
4	learning	2	efficacy	0.066667	attachment	0.027586

* Keywords with a frequency ≤ 1 were excluded.

Southeast Asia

Table 13 exhibits the keyword network analysis results of research articles from Southeast Asia (the Philippines, Thailand, Singapore, Malaysia, Indonesia, India, and Bangladesh). The keywords *kindergarten*, *teacher*, *parent*, and *attitude* were prominent.

Table 13. *The ranking of keywords* in research articles from Southeast Asia by frequency, degree centrality, and betweenness centrality*

Rank	Frequency		Degree centrality		Betweenness centrality	
1	kindergarten	13	kindergarten	0.108911	kindergarten	0.200066
2	teacher	8	teacher	0.069307	teacher	0.082640
3	learning	6	parent	0.059406	parent	0.080792
4	curriculum	6	attitude	0.049505	attitude	0.049043
5	school	5	approach	0.039604	language	0.046337
6	knowledge	5	center	0.039604	development	0.046073
7	science	4	curriculum	0.039604	approach	0.033234
8	parent	4	knowledge	0.039604	center	0.031518
9	language	4	language	0.039604	curriculum	0.029109
10	development	4	development	0.029703	learning	0.028911
11	skill	3	gender	0.029703	science	0.019604
12	process	3	learning	0.029703	activity	0.019406
13	practice	3	perception	0.029703	role	0.019406
14	attitude	3	practice	0.029703	skill	0.019406
15	activity	3	process	0.029703	knowledge	0.014224

* Keywords with a frequency ≤ 2 were excluded.

East Asia

Table 14 discloses the keyword network analysis results of research articles from East Asia (South Korea, Japan, Taiwan, Hong Kong Special Administrative Region of the People's Republic of China, and China). *Teacher*, *kindergarten*, *parent*, *policy*, and *curriculum* were prominent. In particular, topics related to subjects such as *music*, *science*, *language*, and *mathematics* were prominent.

Table 14. *The ranking of keywords* in research articles from East Asia by frequency, degree centrality, and betweenness centrality*

Rank	Frequency		Degree centrality		Betweenness centrality	
1	teacher	36	teacher	0.131068	teacher	0.447744
2	kindergarten	21	kindergarten	0.092233	kindergarten	0.275598
3	curriculum	10	music	0.038835	parent	0.067642
4	music	9	parent	0.033981	policy	0.064130
5	science	8	curriculum	0.029126	school	0.062239
6	parent	8	picture book	0.029126	picture book	0.061797
7	experience	7	analysis	0.024272	music	0.059152
8	ability	7	approach	0.024272	analysis	0.059058
9	narrative	6	language	0.024272	science	0.056304
10	book	6	ministry	0.024272	perception	0.054961
11	relationship	5	policy	0.024272	language	0.052101
12	policy	5	relationship	0.024272	play	0.051622
13	play	5	experience	0.019417	childcare	0.051054
14	picture book	5	inclusion	0.019417	characteristic	0.048171
15	mathematics	5	perception	0.019417	ministry	0.044589
16	language	5	placement	0.019417	experience	0.037272
17	development	5	school	0.019417	relationship	0.034912

* Keywords with a frequency ≤ 4 were excluded.

Oceania

Table 15 discloses the keyword network analysis results of research articles from Oceania (Australia and New Zealand). *Play*, *teacher*, and *kindergarten* were prominent. Notably,

keywords such as *mathematics*, *number*, *assessment*, and *educator* distinguished Oceania from other regions. This region also differed noticeably from others in that the keyword *play* had the highest ranking.

Table 15. *The ranking of keywords* in research articles from Oceania by frequency, degree centrality, and betweenness centrality*

Rank	Frequency		Degree centrality		Betweenness centrality	
1	play	6	number	0.067568	assessment	0.039245
2	teacher	5	teacher	0.067568	kindergarten	0.037394
3	mathematics	4	educator	0.054054	play	0.031840
4	number	3	kindergarten	0.054054	imagination	0.031100
5	language	3	assessment	0.040541	educator	0.028878
6	kindergarten	3	mathematics	0.040541	resilience	0.017771
7	educator	3	play	0.040541	number	0.013699
8	development	3	risk	0.040541	risk	0.012958
9	assessment	3	time	0.040541	mathematics	0.008515

* Keywords with a frequency ≤ 2 were excluded.

North America

Table 16 discloses the keyword network analysis results of research articles from North America (the United States and Canada). *Teacher* and *kindergarten* were prominent. *Mathematics*, *technology*, *literacy*, *games*, and *special education* indicated research trends unique to North America.

Europe

Table 17 reports the keyword network analysis results for research articles from Europe (Belgium, Finland, Germany, the United Kingdom, Italy, and Sweden). *Kindergarten*, *thinking*, *quality*, *learning*, *collaboration*, and *communication* were found to be important, signaling that Europe had its own unique research trends.

Table 16. *The ranking of keywords* in research articles from North America by frequency, degree centrality, and betweenness centrality*

Rank	Frequency		Degree centrality		Betweenness centrality	
1	teacher	5	games	0.089552	mathematics	0.120308
2	kindergarten	5	teacher	0.089552	technology	0.081411
3	mathematics	4	kindergarten	0.059701	kindergarten	0.079150
4	development	4	mathematics	0.059701	medium	0.077341
5	program	3	school	0.059701	efficacy	0.073722
6	literacy	3	efficacy	0.044776	games	0.065581
7	games	3	quality	0.044776	teacher	0.060832
8	efficacy	3	board	0.029851	literacy	0.043419

* Keywords with a frequency ≤ 2 were excluded.

Table 17. *The ranking of keywords* in research articles from Europe by frequency, degree centrality, and betweenness centrality*

Rank	Frequency		Degree centrality		Betweenness centrality	
1	kindergarten	4	kindergarten	0.181818	kindergarten	0.160173
2	thinking	2	quality	0.136364	measurement	0.129870
3	quality	2	collaboration	0.090909	length	0.121212
4	learning	2	communication	0.090909	linear	0.103896

* Keywords with a frequency ≤ 1 were excluded.

Discussion

In this study, content analysis and keyword network analysis were used to examine research article publication trends in APJRECE over a 15-year period. The results are as follows:

First, APJRECE published articles on issues related to early childhood education in the Asia Pacific, presenting continuous discussions on common and important topics pertaining to early childhood education. These topics include children, teacher, education, kindergarten, parent, development, curriculum, and policy.

Second, to examine research trends according to period, three 5-year periods were analyzed. Notably, the range of topics grew more diverse over the course of the three periods. Additionally, unique characteristics of each of the periods were identified. From 2012 to 2016, there were many studies related to *parent* and *family*, whereas research pertaining to *play* and *technology* in education offered newly emerging content. From 2017 to 2021 papers engaged with *learning*, *play*, *time*, and *picture book* were prominent.

Third, the frequency of different methodologies used in APJRECE articles were calculated. During Period 1, qualitative studies dominated the field, yet over time the journal saw a greater balance between quantitative and qualitative research. Furthermore, the results confirm that mixed-method studies and literature reviews were being actively published. Knowledge of which research methods are most appropriate for particular research purposes may prove to be an effective guide for subsequent studies.

Fourth, this paper performed an analysis of APJRECE research articles according to region, thereby identifying studies from various regions, which included East Asia, Southeast Asia, Oceania, North America, Africa, Europe, and the Middle East. While studies were concentrated in Asia, including East Asia and Southeast Asia, during Period 1, the journal gradually expanded to include other geographical regions. What is more, there were a few studies compared different regions. Overall, *teacher*, *kindergarten*, *parent*, *policy*, and *curriculum* were found to be important in all regions, while some keywords were unique to specific areas.

In terms of regional differences, numerous studies that focused on curriculum originated from East Asia. South Korea had the most studies on *mathematics* (Bae & Kim, 2020; Im & Choi, 2020; Lee, 2011; Moon & Lee, 2011); Japan prominently focused on those related to *music* (Mimura et al., 2009; Sano, 2018) and Taiwan had the highest concentration of studies pertaining to *science* (Chen, 2016; Chien, Hsiung, & Chen, 2009; Chien, Hsiung, Chen, & Lin, 2010).

Notably, research related to *play* were highlighted in Oceania; *play*, *assessment*, and *educator* were important keywords in the context of Australia and New Zealand, where they are considered vital elements of the curriculum (Australian Government Department of Education, 2010; Ministry of Education, New Zealand, 2017).

In North America, *mathematics*, *technology*, *literacy*, *games*, and *special education* most

prominent. The US Common Core State Standards divides content into English language arts/literacy and mathematics, which likely explains why *mathematics* and *literacy* predominated (CCSS Initiative, May 22, 2022). Furthermore, the Principles of Child Development and Learning and Implications that Inform Developmentally Appropriate Practice recommend that “Technology and interactive media as tools in early childhood programs serving children birth through age 8.” This is consistent with the finding that studies related to *technology* and *games* were more visible from North America (NAEYC, May 20, 2022).

In summation, APJRECE appears to address universal, general issues about children and education that cut across regions, while also including topics distinct to specific regions. These findings further suggest that the journal functions well as a platform for disseminating issues of interest in childhood education among various regions, including those beyond Asia. Additionally, the results indicate that the issues of importance it covers change over time. In particular, because this international journal innovated a course forward by publishing both comparative and convergent studies originating from different regions, meaningful changes took place.

Given both the findings and the discussion above, this study makes the following recommendations for APJRECE’s continued development: first, because identifying the region in which some studies had been conducted was difficult, clearer and more detailed information on the context of the studies could help improve the reader’s understanding. In this way, the journal would better serve as an international platform for the exchange of ideas among different regions.

Furthermore, we recommend that the journal build a platform for the purpose of publishing special issues on common topics of interest. From this perspective, APJRECE’s recent decision to include a Guest Editor who addresses topics such as *play* through special issues seems to be a seems an effective change. In fact, the journal is expected to showcase leadership in becoming an even more influential platform for sharing and comparing study results on common topics and for exploring new directions in research on early childhood education.

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