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Developing a growth mindset in education: a bibliometric analysis and its challenge during pandemic

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ABSTRACT

The growth mindset is essential for learning because students encounter numerous obstacles during the pandemic. However, only a few studies have examined research trends in growth mindset pedagogy. In filling this gap, this study aims to conduct a bibliometric study using the growth mindset pedagogy during the pandemic. Data from 81 Scopus-sourced scholarly articles on growth mindset in education from 2020–2022 was used. VOSviewer qualitatively analyzed the data. Results showed that the research cluster's growth mindset is diverse and adaptive to learning dynamics, notably during the COVID-19 pandemic. Several research clusters examined instructors, students, and parents' roles in learning. Another cluster focuses on academic achievement and teacher efforts to improve student performance. The research addresses student issues like depression, academic fatigue, and suicide ideation. Research on a growth mindset in education has grown quantitatively since 2021. Clusters 1, 2, and 4, 5 have the most research on active learning design to improve student academic performance and accomplishment through teachers and other supporting elements. Even though academic fatigue can lead to depression and suicidal ideation, research on academic achievement-related student issues is scarce. In conclusion, a growth mindset can significantly enhance academic performance and solve learning problems.

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1. INTRODUCTION

The global education system faces new challenges due to the spread of the COVID-19 virus. Teachers and students must adjust to new regulations and practices. Students had several challenges throughout the pandemic, causing stress [1], increased anxiety and distress [2], loss of interest in educational activities, decreased student involvement in the educational process [3], diminished quality of student interaction with peers [4], and reduced motivation [5], [6]. Many students also complained of difficulties concentrating during online learning, and busy assignments [7], [8].

Students can either grow from their obstacles or give in to them. Identifying and solving those obstacles requires a mindset [9], [10]. Mindset varies from fixed to growth mindsets [9]. A growth mindset is a belief that one's qualities can change with others' efforts, strategies, or assistance. However, fixed mindset

individuals accept that the self-quality is given because they view their intelligence as unchanging and unmodifiable, so any work they do is predetermined [9], [11]. Thus, a growth mindset should benefit pupils experiencing challenges [12]. Previous research found the significance of the growth mindset in fostering college students' learning engagement [13] and academic success during COVID-19 [14], [15].

Growth mindset persons are more likely to persevere and progress when faced with challenges. Fixed-mindset people avoid challenges, fail to maximize their potential [16], and give up easily [9]. With a fixed mindset, people often feel helpless and blame their academic failure. However, students with a growth mindset view failure as challenging to learn, improve their quality, and achieve higher [9].

The topic of growth mindset pedagogy has received much attention from previous researchers. Therefore, research trend mapping is carried out to determine the research dynamics on this topic. In general, researchers use various methods: a systematic literature review [11], [17], scoping literature review [18], a meta-analysis [19], and bibliometrics [20]. These studies examine the growth mindset based on its relationship with mathematics education [20], psychological distress [19], and human resource development [18].

The previous study was applied to the elementary school level [11], [17]. The study results show that the growth mindset can increase student achievement and involvement in learning [11], [20] and enhance mental health [19]. Thus, growth mindset pedagogy improves academic performance and mental stability. Despite limited research, the growth mindset improves learning and academic achievement. The growth mindset pedagogy study was small-scale and integrated with particular interventions [17]. Finding a central study theme to uncover systematic development patterns becomes difficult as the area evolves. Research trends reveal topic overviews, knowledge gaps, novel ideas, and future research prospects [21], [22].

Furthermore, based on a new viewpoint on the importance of particular articles, authors, concepts, and writings related to these essential studies [23], [24], bibliometric research may offer academics the necessary framework for establishing the significance of their contributions to the topic [21]. Thus, scientific progress from global to author levels could be assessed by the bibliometric analysis [25] to understand the issue better and recognize teaching and learning research variables. Based on this background, this study fills the gap by examining three research focuses on growth mindset pedagogy: i) the research cluster; ii) the topic changes annually; iii) the research direction based on research density. This study maps growth mindset research patterns in education during a pandemic to identify more research opportunities.

2. RESEARCH METHOD

2.1. Research design

The research method is bibliometric analysis, conducted in quantitative [23], [26], and qualitative research [21]. Bibliometric analysis is a popular and rigorous method of obtaining, researching, and interpreting quantifiable data using published research articles' mathematical and statistical analysis to assess publication information and untied the evolutionary complexities of the subject field [21], [27]. Bibliometric quantifies, evaluates publications, and assesses qualitative research impact using peer review [21], [27].

2.2. Selection criteria for the articles

Scopus bibliographical data was retrieved via article search. Based on relevant theory, this study searched for 'growth mindset in education' and 'growth mindset in learning' during 2019–2022. The search terms used to retrieve relevant sources from the Scopus database are detailed in Table 1.

Table 1. Search string

Search strings
TITLE-ABS KEY (growth *AND* mindset *AND* in *AND* education *) AND (LIMIT-TO (PUBYEAR ,* 2022 *) OR LIMIT-TO (PUBYEAR ,* 2021 *) OR LIMIT-TO (PUBYEAR ,* 2020 *) OR LIMIT-TO (PUBYEAR ,* 2019 *) AND (LIMIT-TO (DOCTYPE ,* "ar" *) OR LIMIT-TO (DOCTYPE ,* "cp" *) OR LIMIT-TO (DOCTYPE ,* "re" *)) AND (LIMIT-TO (SUBJAREA ,* "SOCI" *) OR LIMIT-TO (SUBJAREA ,* "ARTS" *)) AND (LIMIT-TO (EXACTKEYWORD ,* "Growth mindset in education" *) OR LIMIT-TO (EXACTKEYWORD ,* "Growth mindset in learning" *)) AND (LIMIT-TO (LANGUAGE ,* "English" *)) AND (LIMIT-TO (SRCTYPE ,* "j" *) OR LIMIT-TO (SRCTYPE ,* "p" *)))*

Figure 1 shows the search query-driven methods for selecting articles. We retrieved 935 growth mindsets in education and learning articles from the Scopus database. After filtering, 81 papers were left for review. Those papers fulfil the study's requirements.

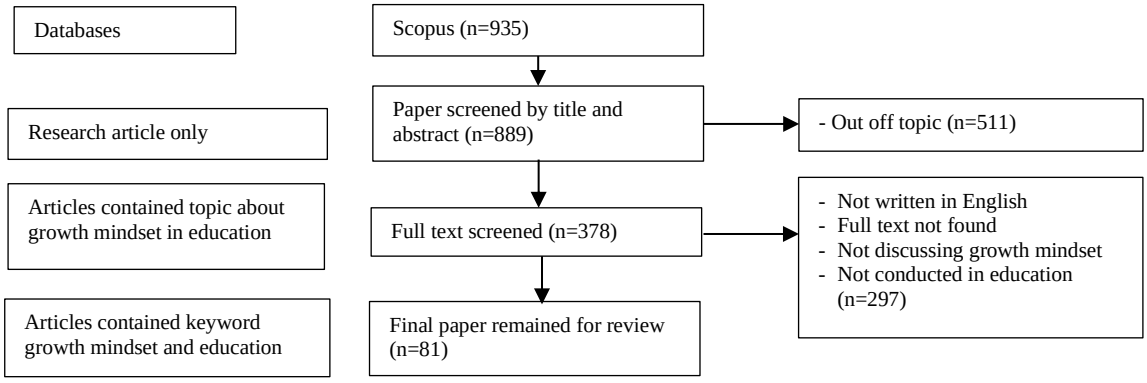

Figure 1. Process of publication selection

2.3. Data analysis

Furthermore, data analysis was conducted in phases, namely i) identifying research trends based on research titles and abstracts; ii) determining research trends based on the co-occurrences of the research topics; iii) analyzing the network to identify research topic clusters based on network visualization; iv) analyzing research trends last five years based on overlay visualization; and v) analyzing research density about second language learning based on density visualization. This study also used three indicators to analyze data: quantity indicators, which measure research output; quality indicators, which measure research performance; and structure indicators, which measure publication-study topic links [27]–[29].

3. RESULTS

3.1. Research cluster on growth mindset in education

This study found nine clusters related to a growth mindset in education. The research clusters on growth mindset are broad and adaptable to learning dynamics, such as examining teacher, student, and parent learning roles; academic success; and psychological issues in education. Figure 2 shows nine research clusters on growth mindset pedagogy based on 81 research article keywords.

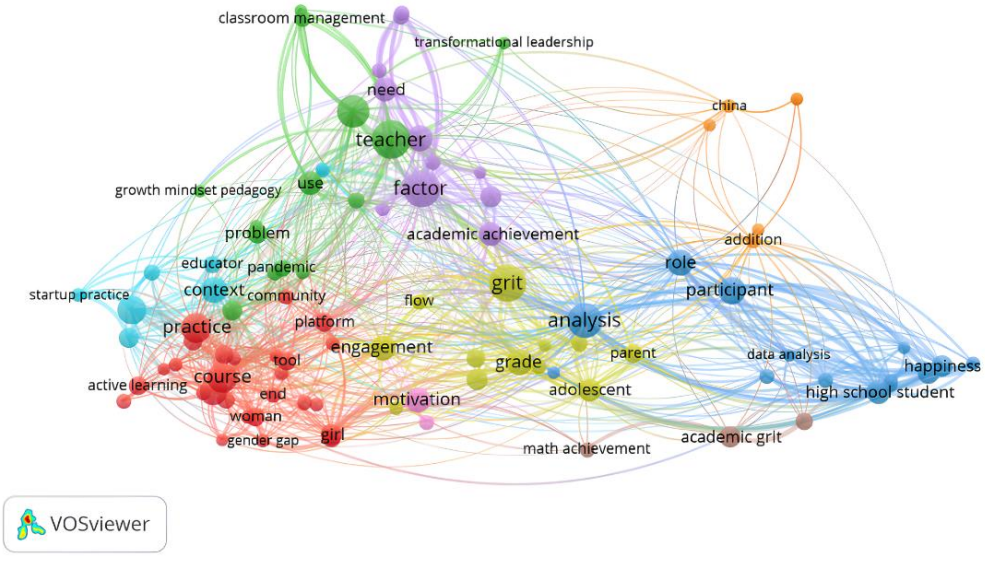

Figure 2. Process of publication selection

Cluster 1 (red) discusses an active learning program that uses technology, science, technology, engineering, and math (STEM) concepts, and gender analysis to achieve learning objectives, student performance, and achievement. Cluster 2 (green) studies teachers' growth mindset pedagogy through learning

strategies and classroom management depending on learning difficulties and demands, notably during the COVID-19 epidemic. Cluster 3 (dark blue) features papers on how teachers can help students succeed through meaningful and pleasant learning. Cluster 3 studies how teachers assist students in overcoming learning issues that lead to depression and suicide. Secondary school, notably in Korea, is this cluster's concentration.

Cluster 4 (yellow) examines how difficulty, persistence, commitment to goals, and parental support affect learning performance. On the other hand, research trends also investigate the negative aspects of achievement orientation, which can cause depressive symptoms. Cluster 5 (purple) highlights self-efficacy, participation, and learning requirements, especially at the university level, as characteristics that affect student competency. Cluster 6 (bright blue) studies educator-created learning settings in start-up-based learning frameworks, especially in engineering. Cluster 7 (orange) discusses education issues such as authoritarian parenting and fraud, notably in China. Cluster 8 (brown) addresses two learning attainment demands that affect student academic achievement and fatigue. Cluster 9 (pink) discusses student motivation and rewards.

The growth mindset in education research examines the roles of teachers, students, and parents. For student achievement, teachers promote active, pleasant, and meaningful learning. Academic success requires enthusiasm, commitment, and persistence. Thus, motivating students for their learning attempts is crucial. Nonetheless, focusing on academic achievement can lead to depression, academic burnout, and even suicide among students. Authoritarian parenting also causes learning issues. Therefore, it can be concluded that a growth mindset can substantially contribute to improving learning outcomes and resolving learning problems. It is crucial to present the research impact based on the most cited articles.

Table 2 illustrates that growth mindset research focuses on psychological factors, gender disparities, and classroom practices. This study found a link between growth mindset teaching, student psychological characteristics, and gender disparities. In addition, some research focuses on academic achievement and STEM.

Table 2. Most cited papers in a growth mindset in education

No	Title	Cluster	Source	TC	C/Y
1	Building grit: The longitudinal pathways between mindset, commitment, grit, and academic outcomes	4	[30]	75	25
2	In search of a growth mindset pedagogy: A case study of one teacher's classroom practices in a Finnish elementary school	1	[31]	38	12,6
3	Growing a growth mindset: characterizing how and why undergraduate students' mindsets change	5	[32]	27	13.5
4	The conundrum of low achievement and feedback for learning	5	[33]	24	12.0
5	CS1: how will they do? How can we help? A decade of research and practice	1	[34]	23	7.6
6	Can test anxiety interventions alleviate a gender gap in an undergraduate STEM course?	1	[35]	21	7.0
7	Growing STEM: Perceived faculty mindset as an indicator of communal affordances in STEM	1	[36]	16	5.3
8	Enhancing children's math motivation with a joint intervention on mindset and gender stereotypes	1	[37]	10	10.0
9	Growth mindset and its predictive validity—do migration background and academic validation matter?	5	[38]	9	3.0
10	Inclusion of students with learning, emotional, and behavioral disabilities through strength-based approaches	3	[39]	9	3.0
11	Promoting a growth mindset in CS1: Does one size fit all? A pilot study	1	[40]	9	4.5
12	What are the potential predictors of psychological capital for Chinese primary school teachers?	7	[41]	8	2.6
13	Testing the association of growth mindset and grades across a challenging transition: Is growth mindset associated with grades?	4	[42]	8	4.0
14	Measuring mastery behaviors at scale: The persistence, effort, resilience, and challenge-seeking (PERC) task	5	[43]	8	4.0
15	Which boys and which girls are falling behind? Linking adolescents' gender role profiles to motivation, engagement, and achievement	9	[44]	8	8.0

3.2. Research overlay on growth mindset in education

Based on the finding of this study, the quantity and interest of study topics in growth mindset studies fluctuate throughout time. This study also found that growth mindset research in education has increased quantitatively since 2021. Figure 3 shows research overlay results. Figure 3 shows that from 2019 to mid-2020, research trends centered on learning success, academic achievement, student outcomes, STEM, and gender differences. Until early 2021, trends include vibrant, fun, and meaningful learning designs with motivation and the involvement of teacher and parents in achieving student academic success. In mid-2021, researchers study academic fatigue, depression, and suicidal thoughts. Classroom management, work engagement, conceptual comprehension, effort praise, transformational leadership, depression, and authoritative parenting style become research subjects 2022.

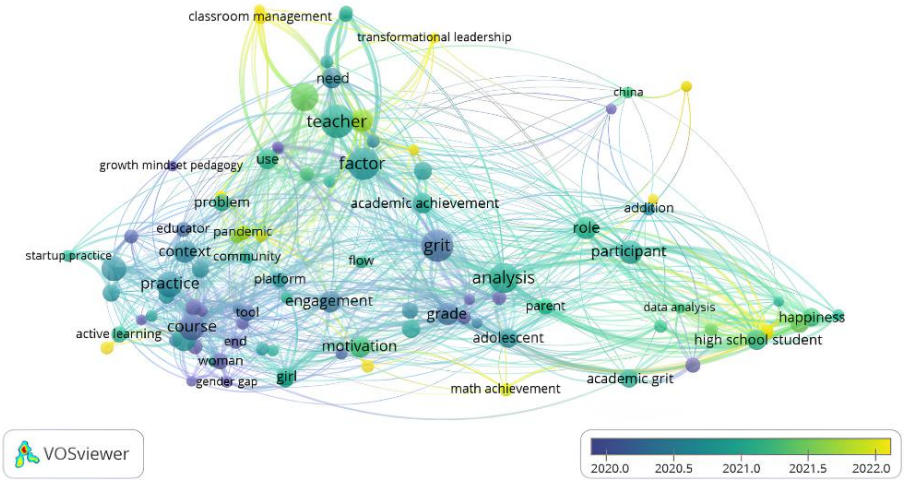

Figure 3. Research overlay on growth mindset in education

3.3. Research density on growth mindset in education

The proliferation of research indicates an annual trend towards growth mindset in the field of education. The number of studies also serves as an indicator of the level of attention that researchers devote to the topic. Quantitative publication data is presented in Table 3. The table reveals that growth mindset education research did not improve significantly between 2019 and 2020. However, publishing numbers will rise significantly in 2021 and maybe through 2022. The number of publications determines research density.

Table 3. Number of annual publications in a growth mindset in education

Period	Total publication
2019	14
2020	16
2021	30
2022	21
Total	81

Figure 4 shows that the most frequently researched topic related to a growth mindset is the role of teachers and growth mindset practices in learning. A growth mindset is also often researched as a factor influencing students' development and achievement. From a multidisciplinary perspective, a growth mindset is often associated with psychological constructs, such as grit, engagement, flow, and motivation.

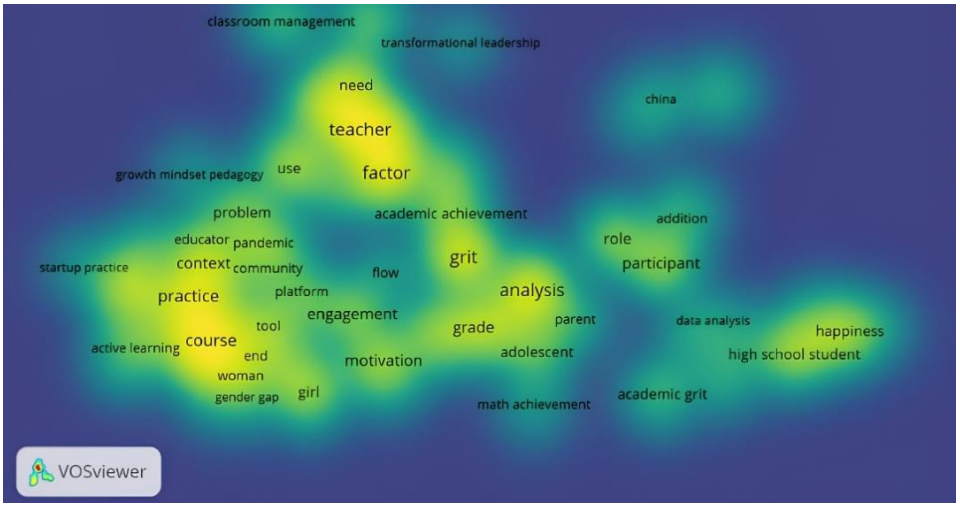

Figure 4. Item density on growth mindset in education

Figure 5 shows that the most discussed research topics are research in clusters 1, 2, and 4, 5, which focus on active learning designs to achieve success and student academic achievement through the role of the teacher and other supporting factors. These findings indicate that research trends still focus on learning designs oriented toward student academic achievement.

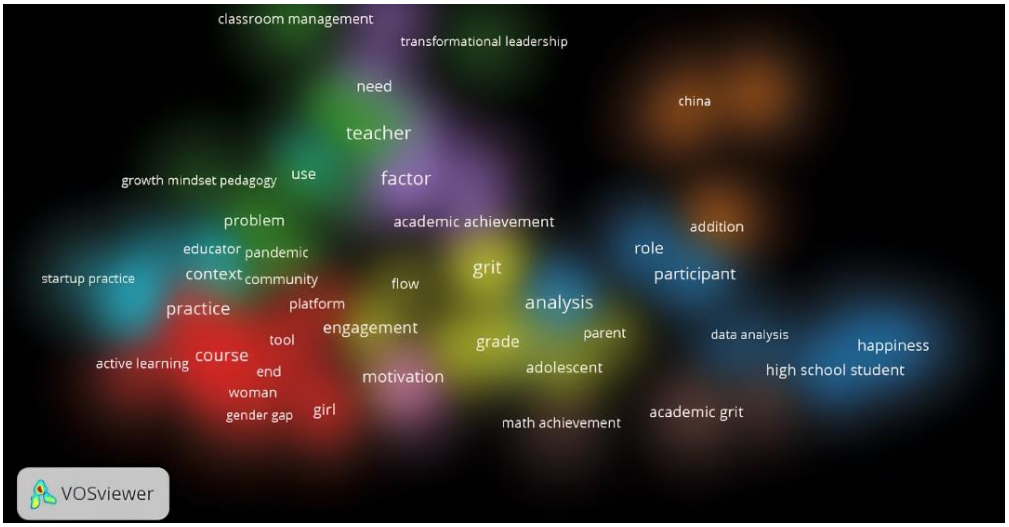

Figure 5. Cluster density on growth mindset in education

4. DISCUSSION

The findings reveal that a growth mindset contributed to student engagement in learning during the COVID-19 pandemic [12]. Previous research also mentioned that the impact of the pandemic on learning was a topic of concern for researchers. Online and blended learning during and after the pandemic is the reason [17].

Growth mindset pedagogy is an interdisciplinary study that revitalizes psychology and education. Researchers discovered that the brain is malleable and that intelligence can be cultivated to enhance educational outcomes by manipulating mindset [11]. Most growth mindset education research analyzes its impacts. However, it is still rare to find research that organizes the themes or topics on growth mindset pedagogy. In addition to academic achievement, the longitudinal trend reveals a movement in research from a mindset to an implicit notion of a growth mindset. Finally, this study gives an overview of the conceptual framework that can assist scholars and practitioners in studying the growth mindset in future research [20].

The results reveal that growth mindset pedagogy research often discusses students' psychological factors, such as changes in students' mindsets [32], motivation [37], commitment, grit [30], emotional and behavioral disabilities [39], psychological capital [41], persistence, effort, resilience, and challenges seeking [43]. Meanwhile, the majority of research on growth mindset factors focuses on academic achievement and engagement [15], [33], [45]–[47], career self-esteem, distress-related outcomes, entrepreneurial skills [20], self-regulated learning strategies [48], anxiety in certain subjects, academic stress, and loneliness [13]. Self-efficacy in specific topics was also reciprocal with students' growth mindset [49]. The results indicate that the growth mindset is one of psychology's most studied themes and is strongly tied to student psychology. In addition, research on growth mindset pedagogy also links gender gaps [35], gender roles [44], and gender stereotypes [37]. The results show that gender is an intriguing demographic element. Gender roles and stereotypes influence students' growth mindset.

Growth mindset pedagogy research also focuses on its application in learning academic outcomes, classroom practice [31], achievement [44], feedback [33], grades [42], and outcomes [30]. This study found that many teaching methods promote a growth mindset. At this point, teachers can use scientifically proven methods to change students' mindset. Using a growth mindset, teachers may utilize students' diverse perspectives to encourage creativity and innovation [50]. These findings support earlier studies indicating that applied research has dominated in the last decade across fields [51].

The mapping shows that teacher role, influencing factors, and grit are the most studied growth mindset pedagogy. Teacher growth mindset influences student growth mindsets [52]–[56]. Several studies show how teachers may foster a growth mindset culture and challenge students' self-perception. Most new research

applies the growth mindset in small groups or individually. However, the growth mindset is still not widely used in school curriculums.

The present curriculum requires teachers to have pedagogical competency [57]. Teachers must understand and implement curriculum changes. In this way, teachers can facilitate learning that promotes student competence [58]. Previous research found that teacher interventions were less significant than student interventions [10] because of substantial and technical obstacles, which teachers can overcome by continuing to investigate knowledge and gaining experience through practice [57].

A growth mindset study has also explored its effects on education. Internal variables from the individual and external environmental factors influence the growth mindset. Self-efficacy in particular topics [49] and motivation have been researched as individual growth mindset elements. On the other side, extrinsic factors include teacher beliefs, parent mindsets, classroom instruction, socioeconomic status, school environment [11], [59]–[62], and parenting style [63]. Those internal and external factors optimize a growth mindset in learning. Students can develop motivation and self-efficacy if teachers, parents, and the school environment are supportive. The earlier study also emphasizes parental involvement in students' activities and parenting styles [64].

The growth mindset's antecedents, mainly internal processes, are less studied than its effects. Future studies can examine internal processes affecting student growth mindsets and create specific programs. Additionally, growth mindset research still emphasizes academic achievement because teachers manage subjects to help students succeed [51]. However, academic achievement-related student difficulties are rarely studied. Moreover, little research has been conducted on how the growth mindset affects noncognitive aspects like welfare, resilience, student self-esteem and cognitive factors like problem-solving and decision-making. It is an essential topic because academic fatigue, which can lead to depression and suicidal ideation, is common among college students.

Grit, growth mindset, and other constructs are frequently investigated [15], [45], [46]. Growth mindset people are more hopeful and persistent because they have self-transcendent motivation for learning [47], [48]. A growth mindset was also linked to grit [15]. Thus, grit changes growth mindset and vice versa. Most research has examined the reciprocal relationship between a growth mindset and grit in usually developing learners. However, inclusion and special education research are few. Grit and growth mindset research is intriguing since special needs kids have unique dynamics.

5. CONCLUSION

According to the findings, growth mindset research is extensive. Active learning design has been thoroughly investigated to improve student academic performance through the teacher's role, growth mindset, and grit. Additionally, many growth mindset issues can be explored. Some involve including the growth mindset in the curriculum, internal variables that drive it, and inclusive education. This research suggests that learning and student internal processes must be emphasized, particularly the growth mindset. An excellent education should boost student well-being and self-actualization. An alliance encompassing the government, educators, parents, students, and students is necessary to advance health, well-being, and education in alignment with the sustainable development goals (SDGs). Moreover, the governor should develop a mental health and well-being curriculum. The curriculum can be taught alone or alongside related courses. The mental health and well-being curriculum teaches resilience, growth mindset, coping, and soft skills.

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