



Exploring Teaching Strategies in Grade 6 Natural Science Lessons: A Case Study in a South African Education District

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ABSTRACT

Active learning in natural science lessons encompasses different teaching strategies. However, it is not only about the strategy but also how it is used in lessons. The South African national school curriculum, Curriculum Assessment Policy Statements (CAPS), emphasizes active learning rather than passive learning. The Trends in International Mathematics and Science Study (TIMSS) have revealed that in South Africa there are still barriers to learner achievement in mathematics and science compounded by a fragile education system. The choice of teaching strategies could be a contributing factor to poor learner performance. Hence, exploring the teaching strategies of natural science teachers is valuable to fill the gap of understanding possible reasons for learner under-achievement in South African schools, albeit not all schools. This study aimed to explore the teaching strategies used by Grade 6 Natural Science teachers in their lessons. The case study involved schools in one education district in a province in South Africa. Seventeen teachers from seventeen different schools participated. Questionnaires were administered to the teachers and five from the seventeen were purposefully selected for semi-structured interviews, classroom observations and document analysis (lesson plans). The findings reveal that passive approaches to teaching and learning strategies such as the telling method, and closed question and answer engagement are still dominant in lessons. Contributing reasons included under-resourced schools and large class sizes. This study recommends regular analysis of teacher competencies in the use of teaching strategies. Further, workshops on active teaching and learning approaches organized by the school and education district office would enhance pedagogical competencies.

Key words: Constructivism, Natural Sciences, teaching strategies, active-learning

INTRODUCTION

The Curriculum and Assessment Policy Statement (CAPS) in South Africa categorically advocates for active learning approaches in school lessons and for the development of critical thinking skills in learners (The Department of Basic Education (DBE), 2011). South African science subject learners in the intermediate phase (Grades 4-6) are still under-achieving compared to most other countries (TIMSS, 2023). There could be many reasons and barriers for the under-achievement, the kind of teaching strategies used in lessons being one. While there may be no one ideal strategy to promote active learning and the development of

critical thinking skills in learners, teachers need to have knowledge, skills and pedagogical insight to prepare lessons aligned to active learning (Killen, 2016). Core to critical thinking is transformative education that promotes analytical learning, creative adaptation and problem-solving opportunities (Changwong et al., 2018). Critical thinking involves active processes such as conceptualising, analysing, constructing and discovering new knowledge, evaluating information, communication and reflecting on thinking amongst others (Pillay & Govender, 2018; Venter et al., 2022). However, teachers can promote critical thinking in learners through the use of appropriate teaching strategies for a lesson to support active learning (Netshivhumbe, 2025). Teaching strategies methods are contributors to the quality of education for school learners in a country (Mgyabuso & Mkulu, 2022). It is therefore valuable to explore the teaching strategies used by Natural Science teachers within the intermediate phase to better understand barriers associated with achievement in the natural science subject in South African schools. Grade six is the final year within the intermediate phase after which learners progress to the senior phase. This case study was an attempt to fill gaps to understand barriers to science learner under-achievement in South African schools from a teaching strategy perspective. This paper focuses on two research questions, which formed part of a bigger study. The two questions are: (1) What teaching strategies are used by Grade 6 Natural Sciences and Technology teachers in their teaching in the selected education circuit? (2) How do the teaching strategies of the Grade 6 Natural Sciences teachers align to the active and critical learning expected within the CAPS guidelines?

LITERATURE REVIEW

Effective teachers are able to transform content in structured ways, to motivate and provide opportunities for learners to engage with learning activities (Killen, 2016). Teachers need to understand pedagogical strategies and implement them effectively. Teaching strategies encompass the methods and techniques by teachers for learners to best achieve the learning outcomes through being active participants in learning (Bhalli et al., 2016; Killen, 2016). Active learning involves learners being opportunities to be critical, creative, give personal meaning, make judgements, engage in metacognitive activities and co-construct knowledge with significant others such as their peers and teachers (Dreyer & Loubser, 2016; Roche et al., 2016; Arslan & Demirtas, 2016). Over the past few decades, effective teaching has been conceptualized as learner-centred rather than teacher-centred or teacher dominated (Killen, 2016).

Teacher-centred approaches are described as using direct-instruction for a major part of lessons, under the direct control of the teacher, behaviouristic in approach, teacher dissemination of knowledge and anti-dialogue promoting passive learning and often rote learning (Mopho, 2018; Mustafa, 2023). In a study in Botswana, which involved six primary schools from rural, semi-urban and urban areas it was found that teacher-centred approaches (authoritarian pedagogy) still dominated despite the National Curriculum advocating for critical thinking skills development (Mopho, 2018). The study used teacher lesson plans, classroom observation and interviews to reach the conclusion of the dominance of teacher centred approaches in these schools. The CAPS in South Africa also advocates for the development of critical thinking in learners and for the use of learner-centred approaches to lessons.

Learner-centred approaches actively engage learners, with the teacher acting as a facilitator, while incorporating inquiry-driven learning activities, promoting collaborative learning, and encouraging critical thinking (Killen, 2016; Bilankulu & Ntuli, 2024). Approaches such as inquiry learning and questions and answers should involve the teacher asking compelling questions; learners should also be encouraged to generate higher thinking questions (Killen, 2016). Active cognition needs to be emphasized as in the present day, technological tools such as AI may negate active cognitive engagement if used passively. Studies in Tanzania in two secondary schools using an experimental approach, observations, interviews, document analysis concluded that learners exposed to learner-centred teaching were motivated and performed

better in their assessment (Kamugisha, 2019). However, it is acknowledged in the literature that there are also challenges associated with the implementation of learner-centred approaches in classrooms (Qambaday & Mwila, 2022; Potokri & Mwelitondola, 2022; Mgyabuso & Mkulu, 2022; Martin-Alguacil et al., 2024). These include inadequate training of teachers, large classes and pressure to meet the completion of syllabus-driven curricula.

Constructivism

A constructivist paradigm underpinned this study. The roots of constructivism can be traced to the thinking of philosophers such as Dewey (1859-1952) and Jean Piaget (1896-1980) (Najjemba, 2021). For Piaget, learning is not knowledge accumulation but involves active internal processing such as assimilation (Torre et al., 2021). Within the school context, the basic premise of constructivism is that meaningful learning occurs through opportunities for learners to construct and reconstruct their own representations resulting in assimilation into their own matrix of understanding (Killen, 2016; Najjemba, 2021). Later, constructivism was expanded based on the ideas of Vygotsky (1896–1934) interpreting learning as meaning constructed through social interaction between the learner and significant others (Najjemba, 2021; Rigopouli et al., 2025).

One of the tenets of constructivist thinking is that learning is an active process and teachers need to facilitate learner support through various teaching strategies (Killen, 2016). Constructivism is sometimes perceived as a “theory of knowing” than a “theory of teaching” as it advocates a non-prescriptive framework for teachers to understand learners and to work with them (Kretchmar, 2015). However, Killen (2016) points out that constructivism is often misperceived as not having any direct instruction from the teacher. Nonetheless, continuous telling, content narration or text-book reading by the teacher and note taking by learners in lessons negate constructive engagement (both cognitive or social). Therefore, the constructivist teacher should focus on opportunities for active learner engagement with minimal direct teacher transmission of subject content or passive demonstrations, minimal intervention and correction of mistakes (Woods & Copur-Gencturk, 2024).

METHODOLOGY

This study followed a case study approach with a mixed-method design for data collection. Common elements of case study research designs include in-depth study of phenomena, issues and dynamic interactions bounded within real contexts, the use of multiple sources of evidence or multiple data collection approaches with convergence on the same context (Marshall & Rossman, 2016; Ramchander, 2018). To get an in-depth understanding of the teaching strategies implemented by Grade 6 Natural Science teachers (NS) this study involved a case study of one education district in South Africa. A mixed method approach integrates or connects quantitative and qualitative data collection and/or analysis within a single study or in a multiphase enquiry and is underpinned by a pragmatic philosophy (Aramide et al. 2023). A concurrent mixed-methods approach was used in this study. Questionnaires, classroom observations, semi-structured interviews and document analysis were used to gather the data. From the purposefully sampled twenty schools in the circuit, seventeen teachers from seventeen different schools eventually participated in the study. Participation was voluntary and non-participation was not questioned. Questionnaires were given to all schools. The questionnaire elicited what strategies do the teachers use in their science lessons. From the seventeen respondents the researcher purposefully and conveniently approached eight schools to visit for interviews, onsite-lesson observations and for document analysis of the teaching lesson preparation plan to get the data required. Five schools eventually participated but was sufficient to get a baseline understanding of the teaching strategies. The choice of the three schools to withdraw was respected and reasons were for withdrawal were not requested as per ethical protocols. The interviews,

observations, lesson plans were coded in according to the teaching strategies in accordance with the active learning principles elaborated in the CAPS policy and underpinned by the theory of constructivism. Frequency counts were computed for the questionnaire. Trustworthiness was ensured through the use of multiple data collection strategies and through validation of the data collection instruments with two experts in the field. Ethical protocols were observed. Permission to include the schools in the study was granted by the provincial Head of Department for education. The study was approved by the university ethics committee in the university where the study was registered. Individual participation was voluntary and pseudonyms were used in the analysis and reporting. A limitation of the study was that only one lesson of each teacher was observed, the findings could have been different if a number of lessons was observed. Time and convenience for the teachers and the researcher significantly influenced the decision for a single observation.

RESULTS/FINDINGS

Participant teacher profile: Age, experience and qualification to teach Natural Sciences

In the questionnaire teachers were asked to provide their biographical details. The response to age, teaching experience and qualification to teach are presented in table 1. Biographical information such as teaching experience was important for analysis whether experience was related to the active teaching strategies implemented. The school locations ranged from rural and semi-rural areas to townships and suburbs.

Table 1. Profile of the participants

Item	Responses				n
1. Age	25-30yrs	31-40yrs	41-50yrs	51-60yrs	
	3	7	5	2	17
2. Teaching experience (in years)	1-5yrs	6-10yrs	11-13yrs		
	11	5	1		17
3. Qualified to teach NS	9				17
Unqualified to teach NS	8				

The actual ages of the teachers ranged from 29 to 53 years. The teaching experience ranged from 1 year to 13 years. This indicates that even the teachers who are forty and above have not been teaching all their lives. Most of the teachers (eleven) had between one and five years of experience (Table 1). However, eight of the teachers were unqualified to teach Natural Sciences and Technology. Teachers who were not qualified to teach Natural Sciences and Technology had to do so as per allocation by the school's management.

Research question 1: What teaching strategies are used by Grade 6 Natural Sciences teachers in their teaching in the selected education circuit?

In the questionnaire, teachers mentioned a variety of teaching strategies which included: telling, demonstration, observation, question and answer method, use of technology, group activities, practical tasks, discussions, hands-on methods, real-life scenarios, problem solving, textbook teaching and investigations. The responses indicate that natural science teachers are aware of different strategies that can be used in science lessons. Table 2 lists interview responses of the five selected teachers to the teaching strategies they use and some key challenges identified within their contexts.

Table 2. Teaching strategies: Interviews

Teacher	Teaching strategies	Key challenges identified
A	Telling, demonstration, observation and question and answer method	Lack of teaching resources
B	Question and answer, group work	Large class sizes
C	Experimental activities, telling, question and answer	Poor literacy levels / lack of teaching resources
D	Interactive learning	Concentration issues
E	Question and answer, group work	Lack of teaching resources

Learner-centred strategies such as group work and practical approaches were mentioned. However, the telling method is a passive transmissive teaching strategy not aligned to active and critical thinking as expected in the CAPS subject guidelines, was also mentioned. The question and answer strategy could also be passive depending on how the question is phrased (where one word closed answers are expected). However, this was not probed further. Key challenges that emanated from the interviews are lack of teaching resources (mentioned by Teachers A, C and D), large class size, and factors relating to the learners namely low concentration spans and poor literacy levels.

Research question 2: How do the teaching strategies of the Grade 6 Natural Sciences teachers align to the active and critical learning expected within the CAPS framework?

The researcher observed the lessons of the five purposefully selected teachers. The teachers made available their lesson plans prior to the lesson observation. The teaching strategies recorded in the lesson plan and the researcher's observation of the lesson are presented in table 3. All the teachers taught the same theme (Solar System) in accordance with the Annual Teaching Plan (ATP) suggested by the national department of education.

Table 3. Teaching strategies: Lesson plan and lesson observation

Teacher	Lesson focus (Solar System)	Lesson Plan	Observed lesson	Experience
A	The sun, the planets and the asteroids	Telling, demonstration, observation, question and answer	Question and answer, narrative/telling dominated, demonstration	3
B	Rotation and revolution of the earth (sun and axis)	Question and answer, group work	Question and answer method, narrative/telling dominated	6
C	Rotation and revolution of the earth (sun and axis)	Experimental activities, telling, question and answer	Questions and answers, telling, guided discovery - questioning, demonstration	9
D	Rotation and revolution of the earth (sun and axis)	Interactive learning strategy	Narrative/telling, group discussions, question and answer, demonstration, interactive learning	5
E	Rotation and revolution of the earth (sun and axis)	Question and answer, group work.	Textbook, closed question and answer, narrative / telling dominated	1

Two critical points arise from the teaching strategies recorded in the lesson plan and how the strategies unfolded in the lesson. Firstly, strategies that promote active learning and critical thinking recorded in the lesson plans were not always used in the lesson. Teachers B and E listed group work in the lesson plan but did not implement this in the lesson. Teacher C also listed experimental activities but did not implement this in the lesson. Secondly, while active learning strategies were listed, passive teaching and learning was observed. Teacher E, for example, listed question and answer and group work in the lesson plan but no group work was implemented. Closed questioning observed in the lesson underplayed critical thinking. Transmission of knowledge through telling learners dominated the lesson of Teacher E. There are gaps between the listed strategies in the lesson plan and those actually implemented in the lesson. However, these gaps could be attributed to the challenges raised in the implementation of active teaching approaches (listed in table 2).

In the lesson of Teacher D well integrated learner-centred approaches were observed. There was active engagement of the learners in the demonstration (questions and answers) followed by group discussion. Teachers C and D implemented tenets of critical thinking by inviting questions from the learners and giving them an opportunity to express their views. All teachers were doing the same theme of the solar system according to the Annual Teaching Plan. Teacher D seemed to have been the only one who applied a constructivist interactive approach effectively. Irrespective of the number of years of experience, the teachers were aware of strategies for active learning. However, years of experience for the observed lesson did not always correspond to the active learning and development of critical thinking expected in lessons. The lesson of Teacher B (with six years of experience) was teacher-dominated while the lesson of Teacher D (with five years of experience) demonstrated an interactive learner-centred lesson.

DISCUSSION

The TIMSS report indicates a declining trend in the Grade 5 learners' science performance in South Africa from 2015 to 2023 (DBE, 2024). One of the speculative reasons for declining performance could be teacher qualification. However, in the TIMSS 18% of teachers nationally had below post-secondary qualifications to teach. In this study there were eight unqualified teachers to teach the subject. However, they held a teaching qualification and showed awareness of learner-centred teaching strategies in their responses in the questionnaire and interviews. A productive teacher should have pedagogical content knowledge and also be able to use teaching methods effectively (Chuene & Singh, 2023). In a case study in Limpopo, South Africa, observation of secondary science classroom lessons of eleven teachers showed only teacher-centred strategies being implemented (Chuene & Singh, 2023). Five were graduates and five were post-graduates in science teaching, with one having not indicated his/her qualification. The Limpopo case study, raises caution about speculation of teacher qualification and the effective use of the science teaching strategies in science lessons or as a reason for poor learner performance.

For productive learning experiences, planning is a pre-requisite (Killen, 2016). All five teachers provided lesson plans prior to their lesson observation. However, despite showing awareness of active learner centred strategies in their interviews, there was a mismatch between their planning and lesson delivery. Only Teacher D showed an exemplary match between the lesson plan and delivery in relation to the teaching strategy in his/her planning. In a study in the National Science Centre in South Africa, lessons were supposed to mimic learner-centred lessons at school but it was found that although education officers indicated knowledge and preference for learner-centred lessons their delivery was teacher-centred (Bilankulu & Ntuli, 2024). Mgyabuso & Mkulu (2022) reported similar findings in a Tanzanian study where teachers had good conceptualisation learner-centred approaches, but classroom lesson observation in four selected schools revealed teacher-centred lessons. Teacher-dominated lessons are contrary to the constructivist approach advocated in the learning principles stated in CAPS (DBE, 2011, 4): "Active and

critical learning: encouraging an active and critical approach to learning, rather than rote and uncritical learning of given truths.”

The value of learner centred teaching strategies within a constructivist paradigm to develop critical thinking in learners is overwhelmingly acknowledged (Bilankulu & Ntuli, 2024; Mgyabuso & Mkulu, 2022; Bremner et al., 2022; Chuene & Singh, 2023; Netshivhumbe, 2025). However, constructivist teaching requires the use of variety of teaching materials and resources, and inadequate resource availability could impact on implementation (Tsehay et al., 2024). There are barriers or challenges to implementing learner-centred teaching strategies, and could be the reason for mismatch in teachers’ awareness of active teaching strategies and implementation in lessons. In this study teachers raised challenges such as under-resourced schools and lack of appropriate in-service support also found in other studies. In a previous study in South Africa, it was found that mainly in rural schools, teacher quality and competency, inadequate support for teachers and the lack of teaching resources contributed to under playing of learner-centred strategies (Manqele, 2017). In a case study of six primary schools in Botswana, barriers raised included large class sizes and an examination directed curriculum (Mpho, 2018). In a study in Ethiopia, similar barriers to implementing active teaching approaches were raised by social science teachers (Tsehay et al., 2024).

CONCLUSION AND RECOMMENDATIONS

The South African formal school curriculum (CAPS) is expected to develop learners to become critical thinking citizens. This can be achieved if teachers implement learner-centred strategies to give learners sufficient opportunities to develop critical thinking skills. The teachers in this study have mentioned effective learner-centred strategies such as group work, experiments, discussions and practical tasks appropriate to the teaching of Natural Sciences in grade six. However, the study concludes that there is a greater mismatch between teacher awareness of learner-centred strategies and their implementation of the strategies in lessons observed. This study confirms similar findings in other studies of science lessons. Teachers have also raised some contextual challenges that may impact the implementation of learner-centred approaches. Lack of resources is one such challenge. The author concurs with recommendations in the literature that greater in-service training is necessary to support natural science teachers in the implementation of learner-centred teaching strategies and addressing of systemic issues by the department of education such as the upgrading of under-resourced schools. Further research can be extended in other education districts involving more schools and greater exploration of reasons for the mismatch between awareness of learner-centred teaching strategies and implementation in science lessons.

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REFERENCES

- Aramide, K., Jacob, U. S., & Pillay, J. (2023). Conceptualisation and contextualisation of mixed-methods research: A review. *Research in Social Sciences and Technology*, 8(4), 14-36.
<https://doi.org/10.46303/ressat.2023.31>
- Arslan, S. & Demirtas, Z. (2016). Social emotional learning and critical thinking disposition. *Studia Psychologica*, 58 (4), 276-285. doi: 10.21909/SP. 2016.04.723
- Bhalli, M.A., Sattar, A. & Asif, M. (2016). Teaching strategies. *Professional Medical Journal*, 23(5), 614–619. doi:10. 17957/TPMJ/16.3206
- Bilankulu, H.J & Ntuli, T.G. (2024). An Exploration of Teaching Strategies Used to Teach Natural Sciences at the Science Centre in Pretoria, South Africa. *Journal of Curriculum and Teaching*, 14: (1). <https://doi.org/10.5430/jct.v14n1p226>
- Bremner, N., Nozomi Sakat, N. & Cameron, L. (2022). The outcomes of learner-centred pedagogy: A systematic review. *International Journal of Educational Development*, 94. <https://doi.org/10.1016/j.ijedudev.2022.102649>
- Changwong K., Sukkamart, A. & Sisan, B. Critical thinking skill development: Analysis of a new learning management model for Thai high schools. *J Int Stud.*,11(2), 37–48. <https://doi.org/10.14254/2071-8330.2018/11-2/3>
- Department of Basic Education (DBE) (2011). Curriculum and assessment policy statement: Natural sciences and technology and technology Grades 4-6. Pretoria, South Africa: Government Printers.
- Department of Basic Education (DBE)(2024). South African 2023 Trends in International Mathematics and Science Study (TIMSS) Highlights Report. Department of Basic Education: Pretoria.
- Dreyer, J.M. & Loubser, C.P. (2016). Curriculum development, teaching and learning for the environment. In Loubser, C. P (ed), Environmental education and sustainability (pp. 145-174). Van Schaik Publishers. South Africa.
- Killen, R. (2016). *Teaching strategies for Quality teaching and learning* (Second edition). Juta & Company, South Africa.
- Kamugisha, N.A (2019). The Use of Learner-Centered Approach and Materials in Teaching and Learning Social Science Subjects in Tanzania Secondary Schools. *International Journal of Research and Innovation in Social Science*, 3 (VIII). ISSN 2454-6186
- Marshall, C. & Rossman, G.B. (2016). *Designing Qualitative Research* (6th ed.). London, England: Sage.
- Martin-Alguacil, N.; Avedillo, L.; Mota-Blanco, R. & Gallego-Agundez, M. (2024). Student- Centered Learning: Some Issues and Recommendations for Its Implementation in a Traditional Curriculum Setting in Health Sciences. *Educ. Sci.*, 14, 1179. <https://doi.org/10.3390/educsci14111179>
- Manqele, C.M. (2017). An evaluation of learner-centred teaching as part of curriculum delivery in under resourced schools. Unpublished Doctoral dissertation. UNISA.
- Mgyabuso, G. & Mkulu, D.M. (2022). The Implementation of Learner Centred Approach and Reposition of Education in Public Secondary Schools in Nyamagana District, Mwanza-Tanzania. *Journal of Humanities and Education Development (JHED)*, 4 (1), 85-99. DOI: <https://doi.org/10.22161/>
- Mpho, O-M. (2018). Teacher centered dominated approaches: Their implications for today's inclusive classrooms. *International Journal of Psychology and Counselling*, 10 (2),11-21. DOI: 10.5897/IJPC2016.0393
- Netshivhumbe, N.P. (2025). Investigating Teacher Instructional Strategies in the Teaching of Natural Sciences in the Senior Phase. *Studies in Learning and Teaching (SiLeT)*, 6 (1), 223-235 <https://doi.org/10.46627/silet>

- Najjemba, J.L. (2021). A social constructivist approach to enhance the literacy skills of English as Second Language pre-service students. Unpublished Thesis. University of the Free State.
- Qambaday, D. & Mwila, P. M. (2022). Learner-Centred Approach: Its influence on Quality of Learning in Public Secondary Schools in Hanang District. *International Journal of Research and Innovation in Social Science*, VI (X). ISSN 2454-6186
- Pillay, R. P. & Govender, S. Exploring the quality of pre-service teachers' critical analysis of cartoons within environmental contexts in the Life Sciences. *J transdiscipl res S Afr.*,17(1), a863.
<https://doi.org/10.4102/td.v17i1.863>
- Potokri, O.C. & Mwelitondola, J.C. (2022). Learner Centred Education in the Teaching of Grade 11 Biology in Ohakafiya Circuit Schools of Namibia. *International Journal of Social Science Research and Review*, 5(3), 30-320. <http://dx.doi.org/10.47814/ijssrr.v5i4.212>
- Ramchander, M. (2018). Shortcomings in case study research design in master's dissertations at South African universities. *The Independent Journal of Teaching and Learning*, 13 (1). <https://journals.co.za/doi/pdf/10.10520/EJC-eeae99bd9>
- Rigopouli, K., Kotsifakos, D., & Psaromiligkos, Y. (2025). Vygotsky's Creativity Options and Ideas in 21st-Century Technology-Enhanced Learning Design. *Education Sciences*, 15(2), 257.
<https://doi.org/10.3390/educsci15020257>
- Roche, M., Adiga, I.K. & Nayak, A.G. (2016). PBL trigger design by medical learners: An effective learning strategy outside the classroom. *Journal of Clinical & Diagnostic Research*, 10(12), 6-8. doi:10.7860/JCDR/2016/21813.9015.
- Torre, N.O., Vidal, O. & Ferran, A.J. (2021). *Constructivist learning models in training programs*. OmniaScience (Omnia Publisher SL). DOI: <https://doi.org/10.3926/oms.407>
- Tsehay, S., Belay, M. & Seifu, A. (2024) Challenges in constructivist teaching: Insights from social studies teachers in middle-level schools, West Gojjam Zone, Ethiopia, *Cogent Education*, 11:1, 2372198, DOI: 10.1080/2331186X.2024.2372198
- Venter, J., Golightly, A. & Petersen, N. (2022). the implementation of case studies to promote the self-directed learning abilities of Grade 10 Life Sciences learners. *Journal for New Generation Sciences*, 20 (1). <https://journals.co.za/journal/newgen>
- Woods, P.J. & Copur-Gencturk, Y. (2024). Examining the role of student-centered versus teacher-centered pedagogical approaches to self-directed learning through teaching. *Teaching and Teacher Education*, 138. <https://doi.org/10.1016/j.tate.2023.104415>

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