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"CORRELATION BETWEEN COGNITVE FLEXIBILITY AND ACADEMIC PERFORMANCE AMONG HEALTHY PHYSIOTHERAPY STUDENTS- A CORRELATIONAL STUDY"

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Abstract: Cognitive flexibility is the ability to quickly transition between different thought processes in order to produce the right behavioral reactions. Academic performance is a "net result" of their cognitive and non-cognitive traits as well as the sociocultural environment in which they are raised. Cognitive flexibility is a crucial and most researched predictor for academic performance.

To find the correlation between cognitive flexibility and academic performance among healthy physiotherapy students.

A correlation study was conducted among 67 healthy paramedical students in which the age group for samples were18-25 years. Samples were collected by screening the inclusion and exclusion criteria. As an outcome, cognitive flexibility inventory scale for cognitive flexibility and academic performance scale for academic performance were assessed.

Spearman's correlational analysis was used for the collected data. Result of this study showed that there was a moderate positive correlation between cognitive flexibility and academic performance in both genders (r= 0.416, p=0.001), in males' moderate positive correlation between cognitive flexibility and academic performance (r=0.452, p=0.001) and in females' weak positive correlation between cognitive flexibility and academic performance (r=-0.301, p=0.001)

In Conclusion Academic performance increases with increased cognitive flexibility.

Keywords: Academic performance, Academic performance scale, Cognitive flexibility**,** Cognitive flexibility inventory scale

Introduction

Cognition is a process of knowing, including awareness, reasoning, judgement, intuition and memory. Cognitive skills are the mental abilities of a person which allow them to process all the information they receive from their five senses. Domains of cognitive functions are complex attention, learning, memory, social cognition, language and EF [1]. Executive function comes under meta cognition which includes working memory, emotional control, planning and prioritization, task initiation and cognitive flexibility [2-3].

Cognitive flexibility is the ability to quickly transition between different thought processes in order to produce the right behavioral reactions to environmental changes. [4] It has been linked to a number of goal-oriented activities, such as problem-solving, multitasking, and judgment [5].

Cognitive flexibility is the capacity to distinguish between when to rely on routines and when to consider alternative options. This skill allows us to transition between a "fast," habit-based decision-making mode and a "slow," more thoughtful decision-making mode that encourages the investigation of alternative options [6].

Early-life neurodevelopmental problems, adolescent clinical illnesses, and late-life dementias can all impair flexibility [7]. Cognitive flexibility, as a crucial cognitive factor is among the most extensively researched and recognized predictors of academic performance, emphasizing its fundamental role in the learning process [8]. Learning autonomy is positively and significantly predicted by cognitive flexibility, so the learner autonomy is increasingly impacted by an increase in cognitive flexibility [9].

Academic performance is a "net result" of their cognitive and non-cognitive traits as well as the sociocultural environment in which they are raised [10]. Changes in mood, motivation, and cognitive function are often accompanied by mental fatigue. Fatigue has a negative impact on academic and professional productivity, which can have a significant impact on day-to-day functioning and personal growth (Nagane, 2004, Ricci et al., 2007) [11]. When it comes to tackling these issues, it is critical that people approach the problems deliberately, identify them accurately, present a variety of options, and consider those ideas carefully. Consequently, people become cognitively flexible as a result of the complexity of daily living [12].

In the context of education, the ability to think flexible is essential for comprehending and resolving unexpected problems, transferring information to new contexts, and adjusting to different learning environments (13). Compared to students who continue their education remotely, those who continue their formal education exhibit greater levels of cognitive flexibility (14).

At all educational levels, getting good grades and succeeding academically are among the key objectives that have favourable effects on students as well as educational systems. Thus, one of the academics' top priorities has always been figuring out what influence's students' academic success. The relationship between students' academic performance and self-efficacy may be mediated by metacognitive methods and emotions associated to learning (15).

Methods

This correlational study was conducted at Alva's College of physiotherapy, to evaluate the correlation between cognitive flexibility and academic performance. The subjects were selected for the study based on the following selection criteria: Age between 18 and 25 years, both male and female, cognitive flexibility inventory score more than 20 and students who have agreed to participate in the study. Known case of cognitive impairment, MMSE less than 24 was excluded from the study. The participants (n=67) were selected using purposive sampling. Verbal consent was obtained from all the participants who were included in the study. Ethical clearance was obtained from the Alva's college of physiotherapy and research centre. Materials used for this study were digital weighing machine and stadiometer to calculate BMI. Before the evaluation, height and weight of the participants were recorded.

Cognitive Flexibility Inventory Scale:

A 20-item self-report tool called the Cognitive Flexibility Inventory (CFI) is used to track the frequency with which people participate in cognitive behavioural thinking challenging therapies (Dennis & Vander Wal, 2010). Cognitive flexibility is a fundamental ability that keeps people from becoming mired in unhelpful thought patterns and allows them to think adaptively in the face of stressful life circumstances. The following two subscales measure crucial facets of cognitive flexibility: Options: assessing the capacity to identify various alternate interpretations for events in life and human behaviour, as well as the capacity to come up with multiple alternate strategies for resolving challenging circumstances. 13 to 91 is the range.

Total the following: 1, 3, 5, 6, 8, 10, 12, 13, 14, 16, 18, 19, and 20.

Control: quantifying the propensity to view challenging circumstances as manageable.

Range: 7–49

Add up items 2, 4, 7, 9, 11, 15, and 17.

Two subscale scores and the overall CFI score make up the scores. Higher total scores suggest greater cognitive flexibility; the range of values is 20 to 140.

Academic Performance Scale

There were eight 5-point scale elements on the APS. Carson Birchmeier et al., of Saginaw Valley State University administered this 5-point rating scale. For investigators with a specific focus on academic, in terms of student performance, the APS is a helpful instrument.

"Strongly Disagree" is scored (1)

"Disagree" is scored (2)

"Neutral" is scored (3)

"Agree" is scored (4),

"Strongly Agree" is scored (5)

Interpretation

SCORE	PARAMETERS
33-40	Excellent performance
25-32	Good performance
17-24	Moderate performance

Statistical Analysis

The collected data were analysed using the statistical package SPSS 22.0 (SPSS Inc., Chicago, IL). To check the normality Kolmogorov Smirnov test was used. As the data were not normally distributed, Spearman's correlation analysis was used to correlate between cognitive flexibility inventory and academic performance among physiotherapy students. The tests were applied at a power of 80% and confidence interval of 95% and the p value and level of significance was set as < 0.05

Results

DESCRIPTIVE ANALYSIS OF COGNITIVE FLEXIBILITY INVENTORY AND ACADEMIC PERFORMANCE

Table-1: Descriptive analysis

Variables	Mean ±SD(Both)	Mean ±SD(Male)	Mean±SD(Female)
Age	22.90+1.329	22.71±1.15	23.11±1.39
Gender	1.62+0.490	2.00±0	1.00±0
Height	163.57+10.67	156.83±5.42	174.46±7.59
weight	60.12+12.866	55.57±12.12	67.46±10.57
BMI	22.48+4.202	22.70±4.78	22.11±3.08
CFI	96.07+13.08	93.90±12.90	99.57±12.84
APS	28.31+6.52	29.71±6.28	26.03±6.37

RELATIONSHIP BETWEEN COGNITIVE FLEXIBILITY AND ACADEMIC PERFORMANCE

The results indicated a moderate positive correlation between cognitive flexibility and academic performance in both genders(r= 0.416, p=0.001), in males moderate positive correlation between cognitive flexibility and academic performance (r=0.452 , p=0.001) and in females weak positive correlation between cognitive flexibility and academic performance (r=-0.301, p=0.001), The analyzed data were

tabulated, and the results were interpreted as follows (Table 2) Graph 1 shows that there was a moderate correlation between cognitive flexibility and academic performance in both genders, (Table 3) Graph 2 shows that there was a moderate positive correlation between cognitive flexibility and academic performance in females, (Table 4) Graph 3 that there was a weak positive correlation between cognitive flexibility and academic performance in male gender.

Table -2: Correlation between CFI and APS in both the genders

Variables	r value	P value
CFI and APS	0.416	0.001

CFI and APS score analysis with spearman's correlation test indicated a moderate positive correlation between them.

Table -3: Correlation between CFI and APS in both the males

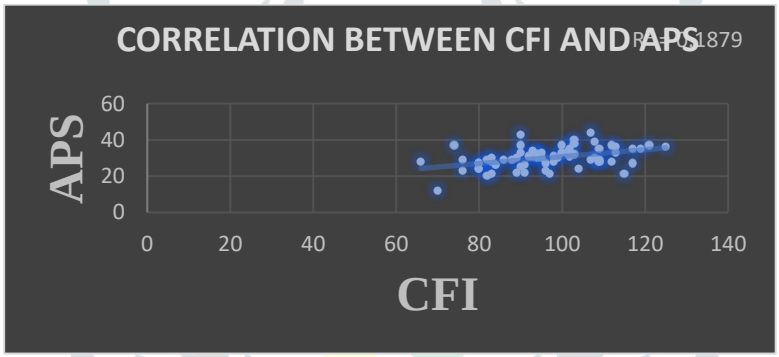
Variables	r value	P value
CFI and APS	0.452	0.001

CFI and APS score analysis with spearman's correlation test indicated a moderate positive correlation between them.

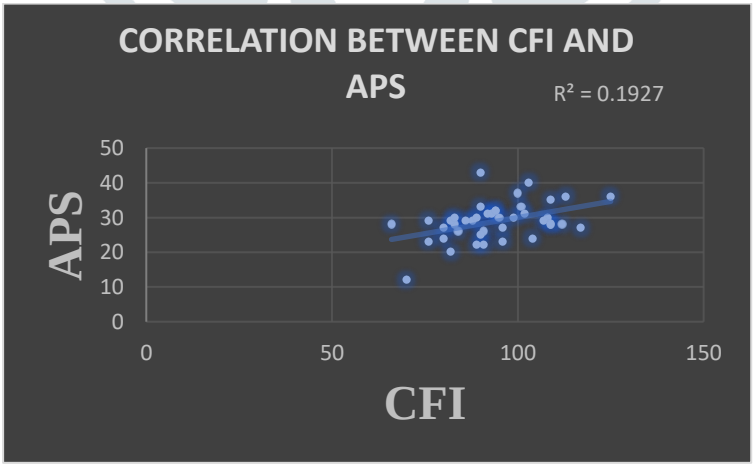
Table -4: Correlation between CFI and APS in both the females

Variables	r value	P value
CFI and APS	0.301	0.001

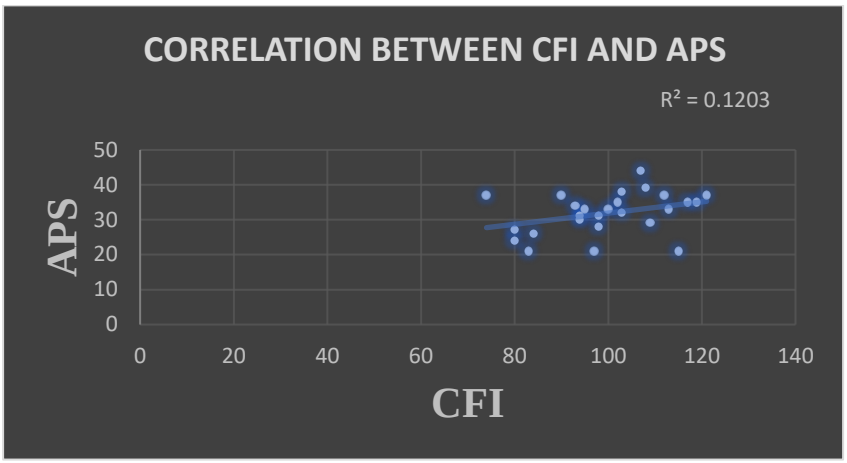
CFI and APS score analysis with spearman's correlation test indicated a weak positive correlation between them.



Graph 1- Correlation between CFI and APS in both the genders



Graph 2- Correlation between CFI and APS in males



Graph 3- Correlation between CFI and APS in females

Discussion

The purpose of this study was to find the correlation between cognitive flexibility and academic performance among physiotherapy students. The result of this study demonstrated that moderate positive correlation between cognitive flexibility and academic performance in both genders, moderate positive correlation in males and weak positive correlation in females which is in line with the study by Yeniad et al., concluded that Preschool is a time of rapid cognitive flexibility development, which continues into adolescence and early adulthood so cognitive flexibility is linked to a variety of significant life outcomes, including as academic performance [16]

A study by Daniella Laureiro-Martínez et al. in the year 2018 concludes that cognitive flexibility plays as an early predictor of successful individual decision-making in a variety of contexts [17]. Cognitive flexibility, defined as the ability to switch between different tasks, adapt to new information, and think creatively, is crucial for problem-solving and effective learning. Students with higher cognitive flexibility may find it easier to understand complex concepts, adapt to different teaching styles, and manage academic stress, leading to better performance.

Cognitive flexibility is the capacity to adapt behaviour or cognitive action in response to changes in context is essential for college-level learning because it helps with problem-solving when familiar knowledge must be applied to new ideas [18].

The current study revealed that moderate positive correlation between cognitive flexibility and academic performance in both genders. The possible reason for this result could be that cognitive flexibility motivates adults to remain open-minded to others' ideas. This can be more effective in helping adults to deal with conflicts when working with peers, listening to multiple perspectives, and learning from others.

Second mechanism could be cognitive flexibility may enhance adults' adaptability to changes in learning situations. Adults who are able to think flexibly are better able to learn new concepts, understand different perspectives, and respond to changing situations. They are also more likely to perform well in educational set ups, as they can apply their problem-solving skills to various academic tasks.

Third mechanism could be cognitive flexibility may help adults to accept new or changing learning technologies. Cognitive flexibility enables adolescents to translate between different tasks and strategies, thus adapting more easily to new learning methods and technologies, and promoting meaningful learning [19].

Students' academic performance is greatly impacted by the ingrained mental habits of media multitasking, which include dividing attention, switching focus, and maintaining numerous trains of thought. By quickly utilizing the limited capacity of learners' information processing channels, particularly their attention processes, multitasking may hinder learning by reducing the amount of time available for effective learning [20].

Our findings align with previous research indicating a positive relationship between cognitive flexibility and academic outcomes. For example, studies by Diamond (2013) and Ionescu (2012) have shown that cognitive flexibility is linked to executive functions, which are critical for academic tasks such as reading comprehension, mathematical problem-solving, and writing. However, our study extends the existing literature by using a diverse sample and controlling for a broader range of confounding variables [21]

The current research reveals that there is weak positive correlation in females and moderate positive correlation in males between academic performance and cognitive flexibility academic performance. These findings suggest that while cognitive flexibility is positively associated with academic performance for both genders, the strength of this relationship differs [22]

The observed gender differences in the correlation between cognitive flexibility and academic performance can be interpreted through several lenses. One potential explanation depends on educational experiences of males and females. Research has shown that boys and girls may develop different cognitive skills and learning strategies due to varying expectations and interactions in educational settings [23]

Males might be encouraged to engage more in activities that enhance cognitive flexibility, such as problem-solving tasks and strategic games, leading to a stronger correlation with academic performance. Conversely, females might be more often engaged in tasks emphasizing memorization and compliance with established methods, which may not directly enhance cognitive flexibility [24].

Previous research on cognitive flexibility and academic performance has often not differentiated by gender, making direct comparisons challenging. However, studies that have examined gender differences in cognitive processes offer some insights. Colzato et al., found that men and women might employ different cognitive strategies, which could influence how cognitive flexibility impacts academic performance [25].

Future Recommendation

- Inclusion of participants from different age groups, educational backgrounds, and socioeconomic statuses to increase the generalizability of the findings.
- Longitudinal study can be conducted to track changes in cognitive flexibility and academic performance over time
- Use of technology and digital tools to measure cognitive flexibility and academic performance can be done. This could include computer-based assessments and online learning platforms to gather real-time data and offer scalable interventions.

Conclusion

Cognitive flexibility moderate positive correlation between cognitive flexibility and academic performance in both genders, moderate positive correlation in males and weak positive correlation in females. which concludes that by improving cognitive flexibility academic performance can be improved in all individuals.

Clinical Implications

- Educational strategies can be tailored to enhance cognitive flexibility in students, potentially leading to improved academic outcomes.
- Educational institutions can develop curriculum that promote cognitive flexibility through activities that require problem-solving, critical thinking, and adaptability.

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