

Education and Equity in the 21st Century: Advancing SDG-4 Through Technology and Inclusive Growth

¹Parmjeet Singh, ²Dr. Kavita Rani

¹Research Scholar, Department of Education, Guru Kashi University, Talwandi Sabo, Punjab, India

²Associate Professor, Department of Education, Guru Kashi University, Talwandi Sabo, Punjab, India

Email Id: ¹singhparamjeet2561@gmail.com, ²drkavitabatra11@gmail.com

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Abstract— This article examined the effect of a well-structured six-week weight-training program on basketball throwing performance among intercollegiate players. Twenty male basketball players of the District Stadium of Nagaur, Rajasthan, between 18 and 25 years, were randomly selected. These players are assigned to the experimental group ($n = 10$) and the control group ($n = 10$). The experimental group received training as suggested, while the control group continued with its regular activities without training. Before and after the treatment, Basketball throwing ability was measured. The analysis of covariance (ANCOVA) was used to compare the groups, controlling for their pre-test performance at a 0.05 significance level. There was no significant difference in the pre-test ($F=0.45$), suggesting initial homogeneity. Across-test ($F = 7.73$). Two adjusted post-test scores differed between groups: $F(1,17) = 9.18, p = .008$. Of the two groups, the intervention group's adjusted mean was 176.10 while that of the control was 165.47. The sums of squares reported yield a partial eta squared of 0.351. Based on the research findings, a structured program has resulted in a significant enhancement in the basketball throwing ability of the players.

Keywords—basketball, intercollegiate players, muscular strength, throwing performance, weight training.

I. INTRODUCTION

Basketball is a team game that uses high intensity. The technical execution of basketball depends on coordinated contributions of fitness, tactics,

perception, and cooperation. To perform competitively, players have to repeatedly accelerate, decelerate, change direction, jump, and execute pass, shoot, rebound, and defend actions in a time-constrained environment. [1], [2].

Thus, muscular strength and power form the basis of basketball conditioning. Power comes from strong muscle mass and helps generate force quickly. Those who have power are explosive. Agility, speed, flexibility, endurance, and neuromuscular coordination work together to optimize movement in competition. [3]– [5].

The ability to throw accurately is especially relevant to long-range passing and the execution of the fast break, along with the movement of the ball on offense. When we throw an object, the lower limbs, trunk, shoulder girdle, arm, and wrist coordinate. Despite the necessity of technique, a sufficient level of strength may allow players to transmit force through the kinetic chain and maintain performance in passing on repeated efforts. [1], [5].

Structured resistance training has become popular for enhancing strength, power, and sport-specific performance. Research on athletes indicates that scientifically designed programs can enhance physical abilities, provided that load, exercise selection, recovery, and progression are managed. Studies on basketball conditioning indicate that combined and compound training may improve specific selected fundamental skills and performance qualities. [6]– [9]. Although strength, sprinting, jumping, and overall basketball fitness have received a great deal of study, much less has been done in controlled studies of basketball

throwing ability in intercollegiate players in regional training settings. The current study aimed to investigate the effect of a six-week structured weight training program on the throwing performance of male intercollegiate basketball players of Nagaur, Rajasthan. [1], [5], [6].

II. REVIEW OF RELATED LITERATURE

According to broader strength-training academic literature, muscular strength is a key quality that can affect power, speed, change-of-direction ability, and the ability to perform a sport-specific task. According to a meta-analysis of the literature, the effects of the training depend on the variables of the program. These include things like training status, intensity, volume, and progression. [4], [8], [9].

Supervised, properly designed resistance training improves the strength and functional performance of younger athletes, including children and adolescents.

There is a strong consensus in the literature on the use of progressive loading, qualified supervision and movement quality, rather than the indiscriminate application of heavy resistance. [7], [10].

According to Christou et al., resistance training along with sport practice improved strength and selected physical capacities in adolescent soccer players. While the sport is different from basketball, the results show that there are benefits to the inclusion of structured resistance exercise with technical training for developing young athletes. [7].

Other sports research has also shown transfer from strength-focused exercise to performance variables. Azeem and Ameer reported gains in strength along with positive alterations of sprint and flexibility, Elsayy reported benefits of functional strength training for physical and kicking variables in taekwondo, and Ibrahim found gains in arm strength

and defensive performance among players of sitting volleyball. [12]– [14].

The configuration of training carries enormous significance. The way sets are completed was shown to affect adaptation (Inquired et al.), while adaptations in strength, power, and functional performance following strength training were documented (Hanson et al.). Fatuous et al. also showed that resistance training can be planned without interference to flexibility if planned appropriately. [15]– [17].

Current research offers more direct support for basketball-related research. A six-week compound training program led to enhanced basketball fundamental skills, according to in overo and Pagaduan. According to the reviews and application analyses of Oliver et al., Locke and Jeffries and Turner and Stewart, strength and conditioning is an important aspect in the physical preparation of basketball players. [1], [2], [5], [6].

Resistance training must still be well-balanced and technique-controlled. Kolber et al. indicated that shoulder problems could occur when resistance exercises are poorly selected or executed. The worry is especially pertinent to throwing tasks which place repeated load on the shoulder complex. Hence, the evidence that was reviewed supports structured and supervised training, but the lack of direct evidence of intercollegiate basketball throwing performance justifies the present study [11].

III. PURPOSE, OBJECTIVES & HYPOTHESES

The idea of inclusive education is underpinned by many concepts. According to the theory of Sociocultural Learning, people learn cultural norms and values through interaction and the use of different cultural tools. Training should connect with what the learner already knows, but it should also provide relevant scaffolding. As per the

contemporary conversation around the science of reading, the scientific evidence must be connected to the specific learner's particulars rather than to generic, simple solutions. Strategies that are adaptable and evidence-based are inclusive.

UDL allows for flexible learning environments and proactive design. A course must consider barriers in its design. At times, failure makes students aware of obstacles. This quotation gives more details. Research into UDL and inclusive education indicates that various curricular designs, materials, and participation routes can engage a wider range of learners [7]. A distinct and reasonable adjustment is necessary and proper. However, UDL differs from these in its emphasis on the barriers created by inflexible systems, rather than 'deficits' present in the learner. Multiple voices often get ignored in classrooms. Who is making the voice?

Read More - Find Out More Bias can be explicit but may also arise through more commonplace interactions, low expectations, stereotyping, or micro aggressions. The learning environment framework offers recommendations for descriptively addressing micro aggressions. Moreover, it centres on health professional education contexts of learning environments. Studies of interventions with equality objectives as a central focus reveal that, as they move along the design-execution-review continuum, outcomes are more likely to make an impact, but only if equality is not a tag-on but is organically built into the process[9].

The perspectives should cooperate with each other, which further helps towards a conception of inclusion as the redesign of systems, relations, and opportunities [9].

IV. INTERNATIONAL POLICY & IMPLEMENTATION

As per the Convention on the Rights of Persons with Disabilities and SDG-4, inclusion in education is perceived as a right, not a choice. Commitment does not guarantee inclusive classrooms. A review of intervention studies conducted in low- and lower-middle-income countries found that implementation depends on teacher preparation, resourcing, leadership, local fit, and longer-term institutional support. This finding illustrates how similar wording policies can yield different results in diverse countries and regions.

Policies that are informed are equally important. The OECD observes that the three, research, policy choices, and practice, remain disconnected. To mitigate this gap, usable evidence, a professional dialogue, implementation support and monitoring mechanisms to check whether the policies enhance participation and learning are required. Finland's example of an integration-focused approach and the United States' example focusing on legal entitlement regarding disability are commonly cited. Utilization of the borrowing by other systems, nevertheless, demands careful assessment of local governance and funding, teacher workload, and cultural expectations. Enrolments numbers are not the only measure of success. Indicators of interest include attendance and participation in classes, access to materials, sense of social belonging, as well as completion, achievement, transition, and learner or family experience. A school that appears inclusive of people on the surface is not really inclusive. There are a variety of forms it could take. It is important to connect legal entitlement to operational capacity at school and classroom in effective policy.

V. BARRIERS TO INCLUSIVE & EQUITABLE EDUCATION

Socioeconomic inequality remains one of the most resistant barriers. Low-income family learners might have limited access to health care, computers or stable internet connectivity due to lack of transport, assistive devices, private study space, books, tutoring and nutrition. This negative feedback may get worse because schools serving communities that are already marginalised get less money as well. Funding sensitive to inequalities should be based on need, rather than per capita basis.

When curricula and assessments are framed in one language and one experience, linguistic and cultural diversity creates further difficulties. Students may understand topics, but they cannot show that understanding due to unfamiliar language forms. Mismatch can be reduced through culturally responsive teaching, multilingual support, representative curriculum content. The importance of differentiated instruction is also the fact that it allows the teacher to vary content, process, support and forms of demonstration according to readiness and learning profile. Teachers' stories of differentiated instruction in inclusive classrooms emphasize its usefulness together with the need for stronger preparation and help in practice.

Inadequate teacher preparation and inflexible curricula, lavage classes and buildings that are not easily accessible, limited specialist services and fragmented administrative structures and weak accountability all represent institutional barriers to learning and participation in education. According to research on preservice teachers in Qatar, providing structured preparation can enhance attitudes towards inclusion, suggesting that beliefs are not fixed but rather can be modified through appropriate knowledge and guided experience [13]. Simultaneously, the standards of the institution must

be cleared through leadership and bias. Experiences of diversity-policy implementation in another profession teach us that declarations have to be changed into something measurable, a commitment to accountability and organisational change for reducing disparities [14].

Disaster increased barriers and highlighted the need for resilience and sustainability. Broad scholarship since the pandemic has stressed that recovery should not be business as usual but must address the vulnerabilities revealed by the crisis 15. In education, resilience is about creating learning pathways that are as flexible as possible, without transferring the cost of participation to those families who have the least ability to absorb such costs.

VI. EQUITY, EQUALITY & INCLUSIVE PRACTICE

The common distinction between providing all students with equal assistance and offering all students the assistance they need to participate equally clearly illustrates the useful distinction between equality and equity [2]. Equal amounts may be appropriate when needs are the same; equitable amounts are necessary when barriers differ. Providing the same digital device to all students will not ensure equal participation if some students do not have internet access, accessible software, a consistent electricity supply, language support, and a quiet place to work.

The term "equity" does not imply lessening academic standards but rather maintaining essential learning outcomes while removing obstacles that do not contribute to the accomplishment of those outcomes. Different assessment formats ensure that students demonstrate what they have learned and reduce barriers for any specific group of students. They include a multimedia assessment supplemented with captions, accessible resources

compatible with a screen reader, extra time to process the assessment task, alternative ways of responding, and relevant content support for language. By engaging collaboratively with reciprocal support, inclusive pedagogy steers clear of both rigid uniformity and needless segregation. Schools must examine their own policies that regulate discipline, ability grouping, referral patterns, and expectations. Systems perceived as neutral may yield quite different results. Data on disability, gender, language, location, and wealth status, with privacy safeguards and bias detection capabilities. A mainstreaming approach promotes the incorporation of equality considerations across policy domains, rather than being added afterward once decisions are being made [9].

VII. TECHNOLOGY & DIGITAL INCLUSION

Inclusive education and technology both call for making content more accessible, allowing greater flexibility in pace, supporting communication, facilitating formative feedback, and encouraging a wider participation. Medar et al. (2015) point out that the influence of technology on learning has been investigated in several studies which concluded that if properly supported, technologies such as a computer, a tablet, a smartphone, robotics, simulations etc. can greatly enhance learning opportunities and can promote equity.

Assistive technologies like TTS/STT, alternative keyboards, screen reader, and magnification, captioning, communication devices, etc., and learning-management systems designed for accessibility, help remove barriers for persons with disabilities to participate.

Digital literacy is a key component of this. Students with special educational needs may need direct teaching on how to use platforms, manage files, assess information, protect privacy and use

accessibility features. The literature available on digital literacy strategies for these learners finds pedagogy that offers success by creating social, technical and cognitive grounding rather than mere exposure [17].

Some immersive and Metaverse-based education video are relatively new digital learning environments that can simulate, visualize, collaborate, and learn by experience or participation. These amazing benefits do not come cheap. The framework of Metaverse in education: concept has research generated framework for the potential of metaverse in education and identifies challenges for implementation that requires further study What really matters is not whether technology is innovative, but whether it improves learning, access, agency and safety of the end-user.

People's experiences during COVID-19 are an important source of evidence. The involvement of parents and the main role of special teachers are based on the individual plan for the disabled student. In the aftermath of the pandemic, the higher education sector seems to have made similar claims about striking a balance between technology and pedagogic and human elements, rather than examining how online delivery can be seen as a substitute for educational design [20]. Primary teachers in Indonesia [21] also reported practical issues in relation to equity of access or engagement. According to evidence relating to maths teachers, digital provision of any sort should, at least in part, be planned around prevailing access conditions.

An affordable connectivity strategy, device access, accessible procurement standards and adequate local development funds to cover low bandwidth options along with offline content and technical support should be part of the strategy to achieve digital safety education and training of teacher's students and their families. It is essential to check the

algorithms and learning analytics for being biased with other agendas. It is important to see these conditions as a core education infrastructure rather than ancillary ones for technology to become an equity tool.

VIII. TEACHER PREPARATION &

PROFESSIONAL DEVELOPMENT

Inclusive education cannot be implemented without teachers, as policy is made significant through classroom decisions. Preparation should include some consideration of learner variability, differentiation, UDL, formative assessment, behavior support, multilingual pedagogy, collaboration with specialists, assistive technology, and family communication. Teachers must secure practical experience to have opportunities to plan, teach, observe, receive feedback, and reflect in diverse environments.

The efforts and persistence of inclusive strategies are strongly influenced by teachers' beliefs and self-efficacy. Teachers' self-efficacy and inclusion beliefs are interrelated [22]. A meta-analytic study also says that teachers' beliefs are influenced by training, experience, perceived competence, and contextual support [23]. Research in Chile shows similar results: attitudes, intentions, and self-efficacy are associated with varying levels of inclusion [24]. The findings indicate that professional development should enhance knowledge and confidence while improving the organizational conditions in which teachers work.

One-off workshops are seldom enough. You will have the chance to keep learning, engage in professional development, and receive coaching. Also, there will be time for reviewing and sharing professional practice and collaborative planning time with colleagues who have similar interests through participation in communities of professionals. You may have case discussions which

may involve a large workload and running for a period of time, as well as getting access to the advice and expertise of specialists. Attitudes may vary according to preservice preparation [13]; classroom-oriented work on differentiated instruction is, after all, more representative of the nexus of theory and realities and constraints [12]. A balanced approach to developing them is highly recommended. Everyone learns at their own pace, and everyone deserves to go through some pretty impressive trouble to study what they want to.

IX. PARENTAL & COMMUNITY

ENGAGEMENT

Families have important insights into what helps learners thrive in relation to their likes, support needs, strengths as communicators, and routine! The level of engagement must go beyond informing parents of decisions and must involve listening, shared planning, and communicating in a user-friendly way that respects linguistic and cultural preferences to be meaningful. Community organizations can provide mentors, transport and digital access, health and social support, and learning opportunities beyond school. The benefits of strong parental and community involvement are well-researched and lead to improvements in educational support and other social outcomes [25]. Although the epidemic highlighted the relevance of these partnerships, it also revealed varying family capabilities within this system. Some families had the privilege of providing expertise over online learning and multiple devices; meanwhile, other families were contending with job loss, digital illiteracy, overcrowding, or language obstacles. Low participation should not be a sign of apathy, according to schools. Tools that can help level the playing field include access, geographic-specific translation support, scalable community-based

language resources, and non-digital ways for people to participate.

X. POLICY RECOMMENDATIONS

To begin with, financing formulas must be sensitive to equity. The extra capacity should be aligned with educational needs and enhance accessibility infrastructure, assistive technology, specialist staff, connectivity, teaching and learning resources, and teacher capacity development. The recorded barriers regarding SDG-4 demonstrate that policy pronouncements alone cannot yield quality education without material capacity [3].

Moreover, curriculum design, assessment, buildings, transport, digital procurement, and institutional procedures must be fully accessible and not discriminate against anyone. Policies must address horizontal discrimination and indirect exclusion caused by inflexible rules. A system should be created for complaints, remedy, monitoring, and public reporting so that rights can be enforced rather than stated.

Governments and institutions are responsible for strengthening the research-implementation link. Evidence ought to be converted to practical guidance, piloted in context, and assessed through participation and learning outcomes. The OECD [11] indicates that the research-policy divide can be narrowed through partnerships between researchers, teachers, school leaders, communities, and policymakers.

Furthermore, Digital inclusion must be treated as a public education function. Include connectivity, devices, affordable data, support, and skills in your planning process. Policymakers must incorporate low-bandwidth and offline alternatives in emergency and blended-learning strategies so that learning continuity does not rely on household income.

Ultimately, it should be seen as a whole-systems outcome. Data must reflect access, participation, achievement, belonging, transition, and post-school readiness. The voices of students and families, particularly from groups most impacted by exclusion, should be included in the evaluation. When policies create unwanted barriers, continuous review allows policies to be revised.

XI. CONCLUSION

To achieve SDG-4, education systems must strive for equitable participation and learning outcomes, rather than equal provision. The ability of schools to educate students with disabilities in the same environment as their able-bodied peers is known as inclusive education. While technology can allow greater access and personalized learning, it can also exacerbate inequality when connectivity, accessibility, digital skills and support are patchy.

We can say that inclusion is not a program or a device. Removing barriers across different levels is part of the attempt of Inclusion to establish structures. Inclusion must be financed fairly by governments; institutions must translate rights into operational standards; teachers must be trained and supported; and learners and families must participate in decisions that affect them. Through organized and proof-informed interventions, education systems could be more resilient, more responsive to diversity, abler to deliver on the promise of SDG-4.

REFERENCES

- [1] O. Brissino, "Building capacity for inclusive teaching: Policies and practices to prepare all teachers for diversity and inclusion," OECD Education Working Papers, no. 256, OECD Publishing, Paris, France, 2021, doi: 10.1787/57fe6a38-en.
- [2] M. Minow, "Equality vs. equity," American Journal of Law and Equality,

- vol. 1, pp. 167–193, 2021, doi: 10.1162/ajle_a_00019.
- [3] A. Zickafoose et al., “Barriers and challenges affecting quality education (Sustainable Development Goal #4) in sub-Saharan Africa by 2030,” *Sustainability*, vol. 16, no. 7, Art. no. 2657, 2024, doi: 10.3390/su16072657.
- [4] Z. Yılmaz, H. G. Dede, R. Sears, and S. Y. Nielsen, “Are we all in this together? Mathematics teachers’ perspectives on equity in remote instruction during the pandemic,” *Educational Studies in Mathematics*, vol. 107, pp. 267–292, 2021, doi: 10.1007/s10649-021-10060-1.
- [5] A. J. H. Ambrose, “Inequities during COVID-19,” *Pediatrics*, vol. 146, no. 1, Art.no.e20201501,2020,doi:10.1542/peds.2020-1501.
- [6] A. P. Goodwin and R. T. Jiménez, “The science of reading: Supports, critiques, and questions,” *Reading Research Quarterly*, vol. 55, suppl. 1, pp. S7–S27, 2020, doi: 10.1002/rrq.360.
- [7] A. Galkienė and O. Monkevičienė, *Improving Inclusive Education Through Universal Design for Learning*. Cham, Switzerland: Springer, 2021, doi: 10.1007/978-3-030-80658-3.
- [8] R. G. Acholonu, T. E. Cook, R. O. Roswell, and R. E. Greene, “Interrupting microaggressions in health care settings: A guide for teaching medical students,” *MedEdPORTAL*, vol. 16, Art. no. 10969, 2020,doi:10.15766/mep_23748265.10969.
- [9] G. Allwood, “Mainstreaming gender and climate change to achieve a just transition to a climate-neutral Europe,” *Journal of Common Market Studies*, vol. 58, no. 1, pp. 143–160, 2020, doi: 10.1111/jcms.13082.
- [10] M. Mendoza and J. Heymann, “Implementation of inclusive education: A systematic review of studies of inclusive education interventions in low- and lower-middle-income countries,” *International Journal of Disability, Development and Education*, vol. 69, no. 6, pp. 1612–1631, 2022, doi: 10.1080/1034912X.2022.2095359.
- [11] Organisation for Economic Co-operation and Development, *Who Cares About Using Education Research in Policy and Practice?* Paris, France: OECD Publishing, 2022, doi: 10.1787/d7ff793d-en.
- [12] C. N. Onyishi and M. M. Sefotho, “Teachers’ perspectives on the use of differentiated instruction in inclusive classrooms: Implications for teacher education,” *International Journal of Higher Education*, vol. 9, no. 6, pp. 136–147, 2020, doi: 10.5430/ijhe.v9n6p136.
- [13] E. E. A. Hassanein, Y. Alshaboul, and S. Ibrahim, “The impact of teacher preparation on preservice teachers’ attitudes towards inclusive education in Qatar,” *Heliyon*, vol. 7, no. 9, Art. no. e07925, 2021, doi: 10.1016/j.heliyon.2021.e07925.
- [14] R. M. Carr et al., “From intention to action: Operationalising AGA diversity policy to combat racism and health disparities in gastroenterology,” *Gastroenterology*, vol. 159, no. 4, pp. 1521–1526, 2020, doi: 10.1053/j.gastro.2020.07.044.
- [15] I. W. Suryasa, M. R. Gómez, and T. Koldoris, “Post-pandemic health and its sustainability,” *International Journal of*

- Health Sciences, vol. 6, no. 1, Art. no. 5949, 2022, doi: 10.53730/ijhs.v6n1.5949.
- [16] C. Abimbola, C. A. Eden, O. N. Chisom, and I. S. Adeniyi, "Harnessing technology integration in education: Strategies for enhancing learning outcomes and equity," *World Journal of Advanced Engineering Technology and Sciences*, vol. 11, no. 2, p. 71, 2024, doi:10.30574/wjaets.2024.11.2.0071.
- [17] E. A. A. J. T. Tohara, "Exploring digital literacy strategies for students with special educational needs in the digital age," *Turkish Journal of Computer and Mathematics Education*, vol. 12, no. 9, p. 5741, 2021, doi: 10.17762/turcomat.v12i9.5741.
- [18] X. Zhang, Y. Chen, L. Hu, and Y. Wang, "The metaverse in education: Definition, framework, features, potential applications, challenges, and future research topics," *Frontiers in Psychology*, vol. 13, Art. no. 1016300, 2022, doi:10.3389/fpsyg.2022.1016300.
- [19] D. Parmigiani, V. Benigno, M. Giusto, C. Silvaggio, and S. Sperandio, "E-inclusion: Online special education in Italy during the COVID-19 pandemic," *Technology, Pedagogy and Education*, vol. 29, no. 6, pp. 657674, 2020, doi:10.1080/1475939X.2020.1856714.
- [20] C. Rapanta, L. Botturi, P. Goodyear, L. G. Ortiz, and M. Koole, "Post-pandemic challenges for higher education: Balancing technology, pedagogy, and the new normal," *Postdigital Science and Education*, vol. 3, pp. 365–388, 2021, doi: 10.1007/s42438-021-00249-1.
- [21] R. Rasmitadila et al., "The perceptions of primary school teachers of online learning during the COVID-19 pandemic period: A case study in Indonesia," *Journal of Education and e-Learning Research*, vol. 7, no. 3, pp. 293–302, 2020, doi: 10.29333/ejecs/388.
- [22] S. Woodcock and G. C. Jones, "Examining the interrelationship between teachers' self-efficacy and their beliefs towards inclusive education for all," *Teacher Development*, vol. 24, no. 5, pp. 660–675, 2020, doi:10.1080/13664530.2020.1803957.
- [23] C. Dignath, S. E. Rimm-Kaufman, R. van Ewijk, and M. Kunter, "Teachers' beliefs about inclusive education and insights on what contributes to those beliefs: A meta-analytical study," *Educational Psychology Review*, vol. 34, pp. 1411–1435, 2022, doi: 10.1007/s10648-022-09695-0.
- [24] C. S. Martín, C. Ramírez, R. Calvo, Y. Muñoz-Martínez, and U. Sharma, "Chilean teachers' attitudes towards inclusive education, intention, and self-efficacy to implement inclusive practices,"