

Introduction

Jump-landing tasks and exercises are common within the athletic community as well as the general population of active individuals. Unfortunately, improper landing mechanics, which may be due to a lack of safe training techniques, can often lead to increased risk of lower extremity injuries such as fractures, anterior cruciate ligament (ACL) ruptures, patella tendinopathy, and others (Bathe et al., 2023). Many athletic organizations investigate training routines and exercises that decrease biomechanical risk factors linked to these injuries. These resources provided inspiration for a designed routine. To limit risk factors, it's recommended that individuals' knee flexion and ankle dorsiflexion angles at jump-landing impact are larger than 30 degrees of motion (Bathe et al., 2023). For this study's frame of reference, the equivalent range of motion is less than 150 degrees for knee flexion and 60 degree for ankle dorsiflexion.

Instructions highlighting different foci of attention can also improve jump-landing biomechanics. Instruction prioritizing the external focus describes tasks relative to the individual's environment. Internal focus relates task to the individual's body. Previous research indicates resultant changes in lower-extremity biomechanics during jump-landing impact (Ericksen et al., 2024).

Therefore, this study aimed to design and test the effects of a 15-minute training routine and instruction modality on jump-landing lower extremity kinematics and vertical jump height.

Materials and Methods

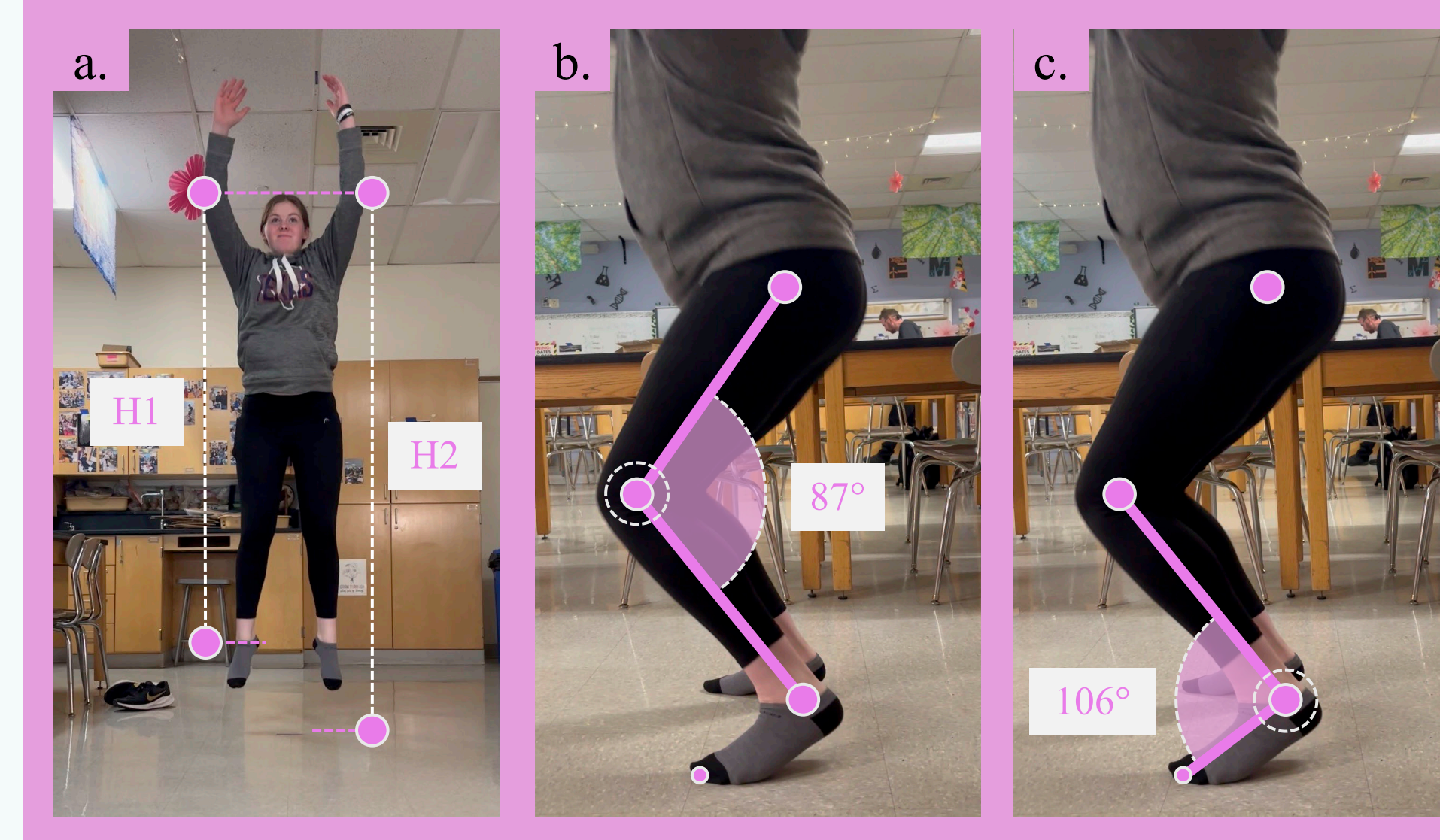
Fifteen students volunteered and provided informed consent to participate in this study. Participants performed a maximum vertical jump test for two period of data collection, both before and after participating in an original training program. Instructions to perform tasks were provided using both internal and external focus of attention in randomized order to eliminate biased effect. (Figure 1).

The 15-minute training routine was implemented twice a week for a total of six weeks. The routine included forward lunges, toe raises, mountain climbers, squats with toe raises, squat jumps, high knee skips, and single leg squats. All exercises were completed for a full minute except for skipping high knees (which were completed at a self-selected pace over 120 yards) and mountain climbers (which were completed in two, 30-second repetitions with a five second break in between). As participants completed the exercises, the researcher provided feedback to correct technique. At the end of the six-week program, volunteers completed the post-training jump test.

Materials and Methods (continued)

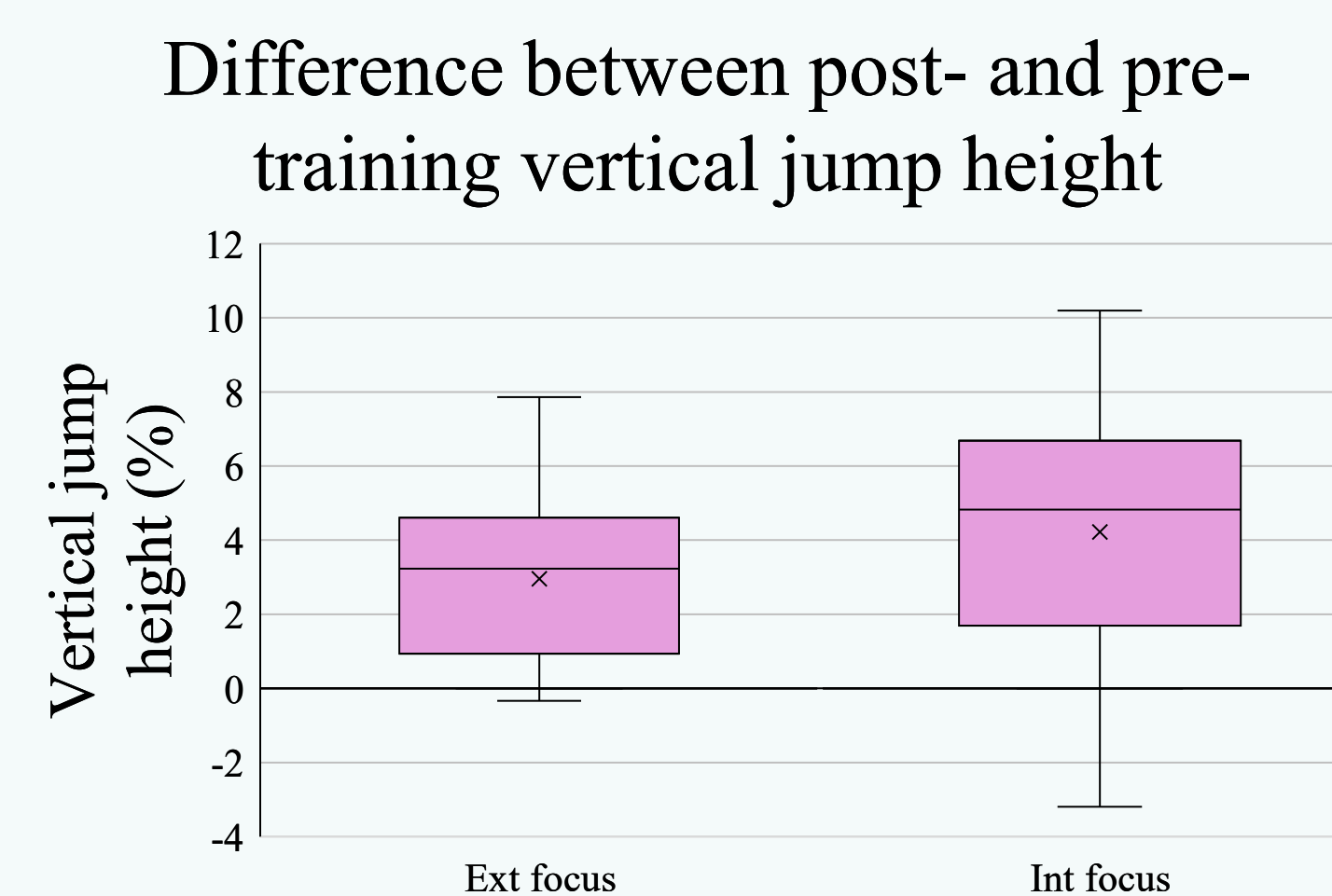
A two-way ANOVA was used to measure the effect of time (pre-training and post-training) and focus of attention instruction (external and internal) on vertical jump height, knee flexion, and ankle dorsiflexion.

Figure 1 (right): Maximum vertical jump height (a) was measured (in.) from initial foot position to the maximum head position (H2) using height (H1) for percent calculations (Graph 1). Knee flexion angle (b) was measured from the malleolus to the lateral femoral epicondyle to the greater trochanter. Ankle dorsiflexion (c) was measured from the lateral femoral epicondyle to the malleolus to the index toe. All measurements were made using Vernier Video Analysis software.

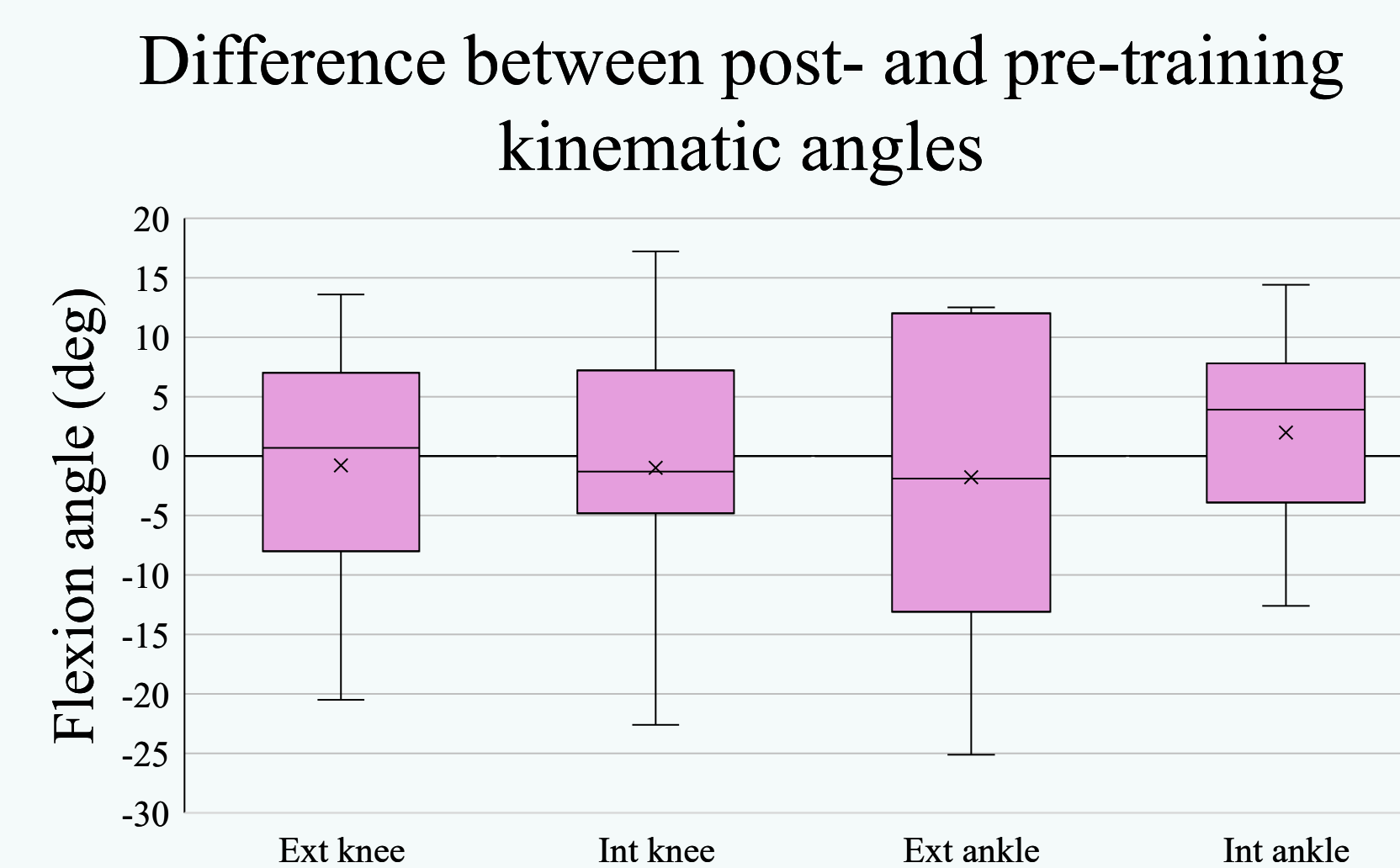


Results

Graph 1 (right): Difference between vertical jump height (% of height) before and after the six weeks of the training routine for both foci of attention (post – pre). Percentage calculated as maximum jump height (in.) divided by participant's height (in.). External focus noted as Ext and internal noted as Int. Means (denoted by ×) used in two-way ANOVA.



Graph 2 (right): Difference between knee flexion and ankle dorsiflexion angles before and after six weeks of the training routine for both foci of attention (post – pre). External focus noted as Ext and internal focus noted as Int. Means (denoted by ×) used in two-way ANOVA.



Results (continued)

There was a significant main effect of time on vertical jump height ($F(1,60) = 6.972, p = .011$) where post-training vertical jump height was higher than that during pre-training, regardless of focus of attention. No main effect of focus on vertical jump height was observed ($p = .882$). There was no main effect of time on knee flexion ($p = .650$) and no main effect on ankle dorsiflexion ($p = .964$). There was no main effect of focus on knee flexion ($p = .174$) and no main effect on ankle dorsiflexion ($p = .432$).

Conclusion

The purpose of this study was to design and test the effect of a 15-minute training routine and instruction modality on vertical jump height and jump landing kinematics. Overall, participants jumped significantly higher after the training program (post) than before the training program (pre, Graph 1). This supports previous research as many of the exercises used have shown to improve technique over time for maximum vertical jump height. These results also mean athletes and coaches of all expertise levels can utilize this program to improve vertical jump height as the exercises included are commonly known and easy to replicate. However, there was not a significant difference in vertical jump height for instruction modality.

There was no significant difference in knee flexion and ankle dorsiflexion for time and focus of instruction (Graph 2). These results demonstrate a need for future studies to investigate other timeframes and instruction types as previous research has shown significant changes in performance after using the exercises included in the created routine. Future studies should also consider using larger samples and comparing athletes' and non-athletes' performance.

References

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- Ericksen, H. M., Earl-Boehm, J. E., & Lally, E. M. (2024). The effect of external focus versus internal focus instruction on jump-landing biomechanics in healthy females. *Journal of Athletic Training*, 59(9), 941–947. <https://doi.org/10.4085/1062-6050-0154.23>
- van Abswoude, F., Nuijen, N. B., van der Kamp, J., & Steenbergen, B. (2018). Individual differences influencing immediate effects of internal and external focus instructions on children's motor performance. *Research Quarterly for Exercise and Sport*, 89(2), 190–199. <https://doi.org/10.1080/02701367.2018.1442915>