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Can Training Class Completion Enhance Biddle Physical Ability Test Performance in Structural Firefighter Candidates? A Pilot Study

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ABSTRACT

The Biddle Physical Ability Test (BPAT) is an entry level test used to identify candidates with the abilities needed to become a structural firefighter. This test simulates firefighting tasks which must be completed in succession in $\leq 9:34$ min:s. Based on the demands of the BPAT, some community colleges will offer semester-long training classes for candidates. However, it is not mandatory for candidates to complete any training or practice prior to attempting the BPAT. **PURPOSE:** To determine whether completing a physical ability training class improves BPAT performance in structural firefighter candidates. **METHODS:** This pilot study involved retrospective analysis of 32 structural firefighter candidates (30 males, 2 females) who attempted the BPAT in one session. All candidates received instruction on how to complete the BPAT, which was performed in the following gear: turnout coat; helmet; gloves; breathing apparatus; athletic clothes; and tennis shoes. Individual BPAT events were timed and collated to provide total time. The events were: dry and charged hose drag; halyard raise, roof walk, and attic crawl; roof ventilation and victim removal; ladder removal and carry; stair climb with hose bundle; crawling search and tower exit; stair climb with air bottles; hose hoist; and return to ground floor with air bottles. Independent samples t-tests ($p < 0.05$) and effect sizes calculated BPAT differences for individual events and the total time between candidates who completed a training class and those that did not. Candidates who failed (via a slow time or disqualification) were also detailed. **RESULTS:** Twenty-nine candidates passed the BPAT, of which 6 completed a training class. The 3 candidates (2 males, 1 female) who failed the BPAT did not complete a training class. There were no significant differences in BPAT times between those that completed a training class and those that did not ($p = 0.10-0.83$). There were moderate effects for the between-group differences in roof ventilation and victim removal (~ 57.83 s vs. ~ 62.48 s; $d = 0.89$), ladder removal and carry (~ 33.50 s vs. ~ 41.35 s; $d = 0.95$), and the hose hoist (~ 47.17 s vs. ~ 54.48 s; $d = 0.74$). Candidates who completed the training class were faster in these events. **CONCLUSIONS:** The results suggest, that while not always the case, those who attend a training class are less likely to fail the BPAT. Although there were no significant between-group differences (possibly influenced by the sample size), it was notable that BPAT tasks that are more physically demanding (victim removal, ladder removal and carry, hose hoist) were finished faster by candidates who had completed a training class. The effect size differences may provide some initial evidence of better skill acquisition for those candidates. Further, training staff have anecdotally noted candidates often struggle with the ladder removal and carry. Candidates who completed the training class were 19% faster in this event, and the female candidate who did not pass the BPAT was disqualified at this event. **PRACTICAL APPLICATIONS:** This pilot study indicated potential benefits of physical ability training classes for structural firefighter candidates, and a need for more research in this area. Certain candidates may be able to complete the BPAT without specific training. However, for candidates who may find the physicality required for the BPAT difficult, they should consider enhancing their task-specific fitness and skills in a training class.

INTRODUCTION

- Structural firefighting can be a very physically demanding occupation. Some example job tasks that may be required to be completed by firefighters include carrying equipment, operating hose lines, stair climbing, forcible entries, ladder raises, crawling and searching, and victim drags (4,5).
- As a result of these job demands, fire departments in the USA typically institute physical ability tests as a method for identifying the readiness of candidates to complete firefighting specific job tasks (2). One example of this is the Biddle Physical Ability Test (BPAT), which has been implemented across California.
- The BPAT is a work sample test for entry-level firefighter candidates that simulates 11 job tasks that must be completed by firefighters when on-duty. These tasks are done in succession, and candidates must complete the BPAT in $\leq 9:34$ min:s (≤ 574 s). This passing time must be achieved before a candidate can be accepted to a participating fire department's training academy.
- Based on the demands of the BPAT, some community colleges will offer semester-long training classes for candidates. However, it is not mandatory for candidates to complete any training or practice prior to attempting the BPAT.
- The purpose of this pilot study was to determine whether completing a physical ability training class improved BPAT performance in structural firefighter candidates.



METHODS

- Retrospective analysis of data from 30 male (age: 24.53 ± 3.55 years; height: 1.82 ± 0.07 m; body mass: 88.40 ± 12.28 kg) and 2 female (age: 21.50 ± 3.54 years; height: 1.62 ± 0.09 m; body mass: 69.18 ± 1.61 kg) structural firefighter candidates was conducted.
- Participants completed the BPAT in one session outdoors at a community college. All candidates received specific instructions on how to complete the BPAT, which was performed in the following gear: turnout coat; helmet; gloves; breathing apparatus; athletic clothes; and tennis shoes.
- The BPAT events are detailed in Table 1 (1). Segments of the BPAT were timed by a staff member using a stopwatch and collated to provide total time.
- Independent samples t-tests ($p < 0.05$) and effect sizes calculated BPAT differences for BPAT segments/tasks and the total time between candidates who completed a training class and those that did not. Candidates who failed (via a slow time or disqualification) were also detailed.

Table 1. Tasks completed within the BPAT (1).

Task	Description
1. Dry hose deployment	Candidate advanced 150-feet of 1.75-inch dry hose with nozzle around two obstacles.
2. Charged hose deployment	Candidate advanced a charged 1.75-inch hose with nozzle 70 feet; 32 feet of hose deployment involved stooping or crawling while advancing hose into a narrowing hallway.
3. Halyard raise	Candidate raised and lowered fly section of a 35-foot aluminum extension ladder one time.
4. Roof walk	Candidate ascended and descended a 14-foot ladder attached to a simulated-pitched roof with a chain saw in hand.
5. Attic crawl	Candidate crawled 20 feet across a simulated attic-joist floor, while carrying a simulated flashlight in hand.
6. Roof ventilation	Candidate stood on a simulated-pitched roof and struck a padded area 30 times with an 8-pound sledgehammer.
7. Victim removal	Candidate carried or dragged a 154-pound dummy around two obstacles 13 feet apart.
8. Ladder removal and carry	Candidate removed a 24-foot aluminum extension ladder from mounting bracket, carried ladder around a diamond shaped course 54 feet long and replaced ladder back on mounting brackets.
9. Stair climb with hose pack	Candidate ascended to fourth floor of tower using stairs while carrying a 49-pound hose pack. Candidate dropped hose pack and begun event 10. Candidate descended tower using same stairs to first floor carrying hose pack.
10. Attic crawl	Candidate crawled on hands and knees on fourth floor of the tower for 60 feet. This was done when candidate was performing event 9.
11. Hose hoist	Candidate ascended to third floor of tower using stairs, carrying 2 air bottles weighing 29 pounds (connected with a 2-foot strap). After dropping off air bottles, candidate then hoisted up a 100-foot section of extended 1.75-inch hose line with nozzle, up and through window, picking up air bottles and descended tower to finish line.

RESULTS

- Twenty-nine candidates passed the BPAT, of which 6 completed a training class. The 3 candidates (2 males, 1 female) who failed the BPAT did not complete a training class.
- BPAT times are shown in Table 2. There were no significant differences in BPAT times between those that completed a training class and those that did not. There were moderate effects for the between-group differences in roof ventilation and victim removal, ladder removal and carry, and the hose hoist. Candidates who completed the training class were faster in these tasks.

Table 2. Descriptive (mean \pm SD) data for the BPAT events for candidates. All variables were measured in seconds (s).

BPAT Task Time	Training Class (n = 6)	No Training Class (n = 23)	p	d
Dry hose and charged hose deployment	35.17 \pm 6.85	35.83 \pm 6.55	0.829	0.10
Halyard raise, roof walk, and attic crawl	75.00 \pm 14.26	76.65 \pm	0.728	0.14
Roof ventilation and victim removal	57.83 \pm 3.92	62.48 \pm 6.31	0.100	0.89
Ladder removal and carry	33.50 \pm 4.55	41.35 \pm 10.74	0.095	0.95
Stair climb with hose pack	53.50 \pm 6.78	56.48 \pm 8.80	0.449	0.38
Attic crawl and tower descent	67.83 \pm 6.62	66.96 \pm 9.18	0.829	0.11
Stair climb with air bottles	35.33 \pm 9.22	38.26 \pm 9.67	0.511	0.31
Hose hoist	47.17 \pm 6.11	54.48 \pm 12.50	0.180	0.74
Return to ground floor with air bottles	27.67 \pm 5.89	25.26 \pm 5.20	0.334	0.43
Total	433.00 \pm 37.46	457.74 \pm 56.34	0.321	0.52

CONCLUSION

- This pilot study suggested that, while not always the case, those who attend a training class are less likely to fail the BPAT. Although there were no significant between-group differences (this was possibly influenced by the sample size), it was notable that BPAT tasks that are more physically demanding (victim removal, ladder removal and carry, hose hoist) were completed faster by candidates who had completed a training class. This was also shown via the effect size differences, which may provide some initial evidence of better skill acquisition for those candidates.
- Further to this, training staff have anecdotally noted candidates often find the ladder removal and carry more difficult. Candidates who completed the training class were 19% faster in this event, and the female candidate who did not pass the BPAT was disqualified at this event.

PRACTICAL APPLICATIONS

- The results indicated potential benefits of physical ability training classes for structural firefighter candidates. This would be especially true for candidates lacking in certain fitness characteristics that would benefit job task performance. For example, it could be expected that greater strength would benefit tasks such as a victim drag (3) and removing and carrying a ladder (6).
- It should be noted that certain candidates may be able to complete the BPAT without specific training. However, for candidates who may find the physicality required for the BPAT difficult, they should consider enhancing their task-specific fitness and skills in a training class.

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