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Establishing and Sustaining Academic and Local Health Collaborations: A Case Study of Practice-Based Teaching and Workforce Development

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Abstract

The pandemic highlighted significant gaps in the public health infrastructure impacted by shortages of public health workers, an undertrained workforce, and years of disinvestment. These gaps required innovative problem-solving by public health agencies (PHAs), including local health departments (LHDs), to respond to rapidly changing community conditions during and after the pandemic. Many schools and programs of public health (SPPH) worked with PHAs to mobilize public health (PH) students through practice-based teaching (PBT). Current research indicates PBT benefits all stakeholders—PHAs, students, faculty, SPPH, and ultimately the community served. However, more research is needed on the utility of PBT in addressing a community's systemic public health issues, the extent to which the academic-community collaboration enhances a PHA's capacity, and the impact of the pedagogy on preparing the workforce for an evolving PH landscape. This paper examines the process of a semester-long PBT course, guided by the PBT STEPS framework, which includes five steps from collaboration to implementation to evaluation of a PBT course. The collaborating PHA and its student group addressed community trauma and resilience issues during the semester. Additionally, it examines the longer-term impacts after the semester for the PHA, community, and the workforce by 1) conducting a formative evaluation to understand needs and gaps in the community; 2) redesigning an intervention that merged the results of the formative evaluation with the intervention developed during the semester; and 3) securing funding and resources for

intervention sustainability. Through the documentation of a post-course partnership between an LHD and faculty at a large school of public health, this case study illustrates the potential for PBT to lay the foundation for ongoing research that supports more impactful interventions for PHAs while bolstering the workforce abilities of students as future practitioners.

Keywords

Academic and Community Collaborations, Practice-Based Teaching, Public Health Training, Workforce Development, Curriculum Design, Community Trauma, COVID-19

1. Introduction

A robust public health infrastructure responsive to the ever-evolving conditions within communities is essential for sustained health [1]. Solving persistent and emerging health challenges requires the support of an appropriately sized and competent workforce. Communities, public health agencies (PHAs) and specifically governmental public health suffered the impacts of decades of disinvestment that decreased capacity, further exacerbated by the demands of the COVID-19 response and the departures of public health workers [2]-[4]. In governmental public health, there are persistent concerns related to the ability to recruit and retain enough staff to meet the current demands of the field [5]. Reimagining public health education so that students can gain immediate and tangible skills can address these gaps in the workforce while capitalizing on the increase in applicants to schools and programs of public health (SPPH) [6].

With the accreditation of 67 schools of public health and 160 public health programs, academic institutions have long had a role in ensuring the creation of a skilled workforce [7]. This priority is reflected in the Council on Education for Public Health (CEPH) standards that require students to demonstrate competency mastery through applied opportunities [8] [9]. As the interest in public health continues to grow, SPPH must empower students to use multidisciplinary perspectives to find solutions to address persistent and growing health disparities for issues ranging from emergency preparedness, disease prevention, and intervention through practice based opportunities. Simultaneously, students can help to alleviate the growing burden on the public health system and gaps in the workforce by applying their newly minted skills in data management, systems thinking, and cross-sector collaboration to enhance workforce capacity [9]-[11]. Through innovative pedagogical techniques, SPPH can create a strong pipeline of professionals ready to meet the challenging and shifting needs of the public health landscape [11] [12].

The challenges presented by the pandemic resulted in opportunities for stronger academic-community collaborations and innovative course delivery. The combined gap in workforce capacity and the shift to virtual instruction compelled

SPPH to reassess the delivery of curriculum content. This shift in curriculum generated more opportunities for students to support resource-constrained public health agencies (PHAs). For example, academic public health established collaborations with understaffed local health departments (LHD) by deploying masters and doctoral students to assist with COVID-19 efforts and enhance organizational capacity [12]-[14]. Even in non-pandemic times, LHDs benefit from public health student volunteers, practicum, or course projects to develop inventive and sustainable responses to real-time problems [15]-[17]. Initiating and sustaining these opportunities, however, requires organizational capacity and time commitment that is sometimes too resource-intensive for the LHD [15]. This results in an underutilization of the support and resources these collaborations offer.

SPPH virtual curriculum adaptations continue to support students' education and the emergent needs of PHAs and communities. Teaching with technology has become an essential instructional medium that, when done effectively, incorporates skills-based opportunities to prepare a workforce-ready SPPH graduate. With this reliance on technology, academic-community partnerships are no longer bound by geography, resulting in a larger network of collaboration and a richer workforce pipeline [18].

One approach to link academia with community is through practice-based teaching (PBT), a pedagogy that relies on the mutually beneficial collaboration between an SPPH course and PHA that serves as the course client for the semester. PBT combines aspects inherent in traditional student learning (assigned readings, lectures, class discussion) with ongoing opportunities for skills-based application while students address a current issue in the community served by the PHA [19]. PBT courses are fast-paced and flexible; students work on issues as they unfold with skill application and decision-making dictated by real-time feedback from the PHA and teaching team [20].

PBT benefits all stakeholders—students, PHAs, faculty, SPPH, and ultimately the community served. In the safety of a classroom, students apply learning competencies required by accrediting bodies and navigate a public health employer's expectations [8]. Other student benefits of PBT include networking with potential employers, developing a professional portfolio, and navigating real-life public health issues and team dynamics [19]-[22]. PBT provides PHAs and faculty opportunities to deepen interdisciplinary, collaborative relationships with each other and within the community [21]. In turn, these relationships bolster the reputational capital for SPPH and offer faculty opportunities to pursue projects and grants. Additionally, PHA's connection with students, faculty, and alumni helps to infuse the agency with innovation and results in access to increased resources and enhanced capacity to further its mission [11]. To yield the greatest results, PBT requires engaged and reciprocal partnerships across these stakeholders [17] [19].

Research shows PBT is an effective pedagogy when delivered in-person or virtually and can be adapted to other disciplines and courses when guided by a

framework such as PBT STEPS [23] [24]. There is evidence of successful implementation of PBT in undergraduate and graduate courses within public health and other health-related disciplines [24]-[29]. However, more research is needed on the utility of PBT in addressing a community's systemic public health issues after the completion of the semester-long collaboration; the long-term outcomes sustained by PBT participants; the extent to which the academic-community collaboration enhances a PHA's capacity including implementation of the ideas generated and resources acquired to implement the ideas; and, the impact of the pedagogy on preparing the public health workforce post-pandemic particularly the knowledge and skills utilized in the workforce post-graduation. Academic-community partnerships are challenging to maintain for various reasons, and measuring the sustained impacts of these partnerships is complicated by the resources (*i.e.*, time and funding) required to evaluate them. This includes engagement of stakeholders and institutional investment in the pedagogy when there are real challenges and conflicting priorities.

This paper uses a case study between a small local health department (LHD) and faculty at a large school of public health (SPH) to examine the implementation of a PBT course during the semester, grounded by the PBT STEPS framework, and the stakeholder benefits after the semester [23] [27]. This examination is timely as SPPH reallocates resources in the shifting higher education landscape to establish and enhance practice-based opportunities to infuse the field with immediate support and innovation. While this paper presents one case study of collaboration, this is one in a series of successful partnerships resulting in tangible deliverables implemented in the field to advance public health.

2. Practice-Based Teaching (PBT) STEPS Framework

The PBT STEPS framework acts as a guide for faculty and SPPH in the design and implementation of PBT courses with maximized outcomes for all stakeholders during and after the semester [20]. This framework entails five steps: (S) Securing Partnerships, (T) Technology and Training for PBT, (E) Engagement and Implementation of PBT, (P) Presenting Deliverables, and (S) Sizing Up Results. These steps reflect three aspects of a successful PBT course—1) planning based on required course competencies and PHA needs; 2) implementation of the pedagogy to deliver technical skills; and 3) evaluation of the learning experience to the students and the quality and utility of the deliverables to the PHA. PBT courses require a significant time investment but provide benefits regardless of the delivery method—in-person, virtual, or hybrid [24] [26].

Since 2013, PBT STEPS has informed delivery of a graduate master of public health (MPH) course, Communication Strategies for Public Health, at an SPH in Massachusetts referred to as "the SPH". The objectives of this course include: 1) developing an evidence-informed intervention tailored to a specific community issue, and 2) creating a communication strategy to engage stakeholders in the intervention. Students engage in an iterative process to develop three deliverables

for the PHA: a) a literature review of the problem and potential solutions, b) a fully developed intervention plan with a budget and timeline, and c) a communication plan with example media executions. Delivering rigorous PBT courses can serve multiple CEPH core competencies and graduation requirements depending on the SPPH classification of the activity. For example, at the SPH the practice-based course provides students with 30 hours toward their 240 hour practicum requirement.

The following case study presents the application of the PBT STEPS framework over a 14-week semester starting in Fall 2021, which evolved into an academic community collaboration in the following two calendar years post-course between the SPH team, and an LHD referred to as "the Agency" (Figure 1). Under the guidance of the Director, the Agency has prioritized its limited resources to address community needs around the opioid epidemic, emergency COVID-19 response coordination, housing instability, and supporting immigrant influx through interagency and multi-sector collaborations.

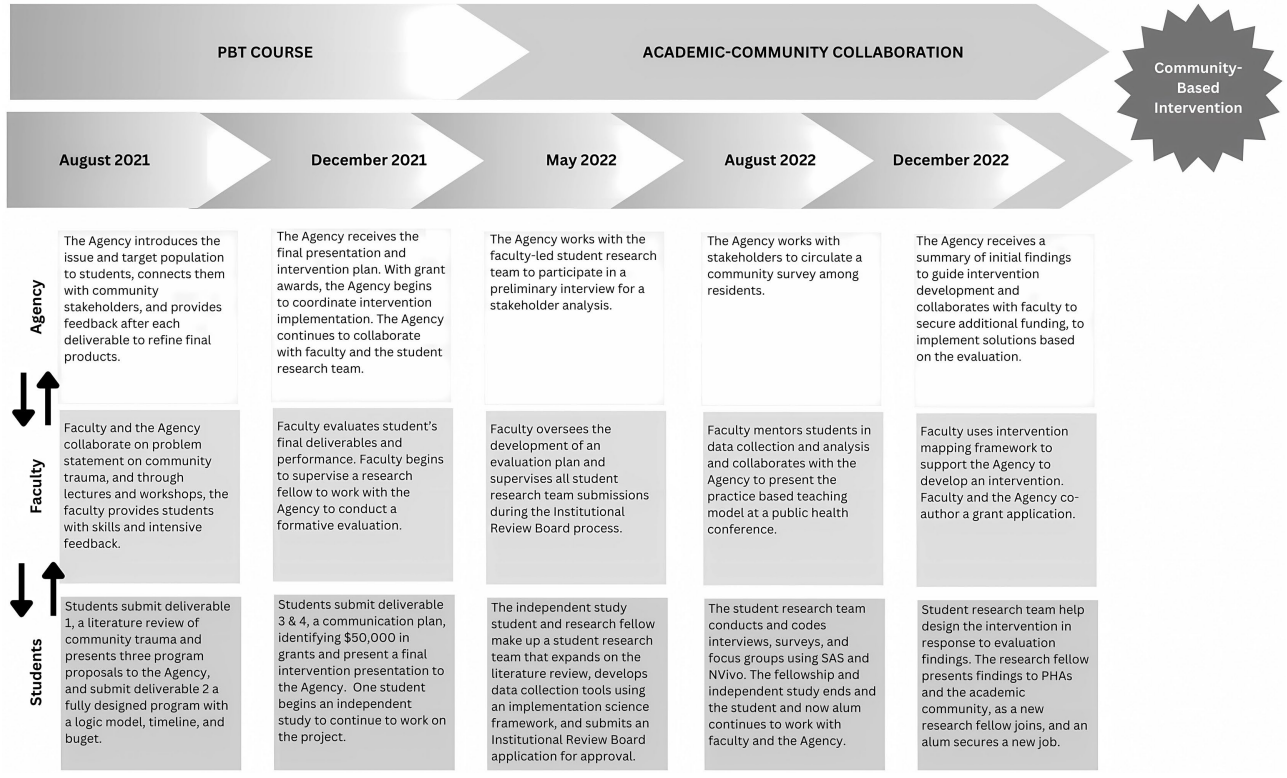

Figure 1. The evolution of sustainable partnership between the agency and SPH: Using practice-based teaching to create community and workforce impacts through long-term academic community collaboration.

Classroom Application of PBT STEPS to Community Trauma

PBT STEPS facilitates a learning experience centered around students' development of deliverables for PHAs through: 1) information dissemination during in-class lectures, required and suggested readings, and guest speakers; 2) class exercises and case studies that facilitate critical thinking and skill application; 3) real-

time discussions between stakeholders to address issues and questions; 4) opportunities for interactions with the PHA and community; and, 5) self-reflection and strategic feedback mechanisms to enhance real-time engagement. Course deliverables are designed to demonstrate workforce skills that align with course competencies and respond to the PHA's priority issues (Table 1).

Table 1. The impacts of practice-based teaching course deliverables in a master of public health intervention design and communication course, fall 2021.

Course Assignment With Description	Student Deliverables	Workforce Skills[1]	Community Impact
Virtual Brainstorm: Intervention Options ***Submission***: *Individual* ***Format***: *Written* ***Length***: 3 *paragraphs* ***Attachment***: *Visuals* ***Description***: *Students individually submit* 3 *intervention brainstorms* *In-Class Time*: ≈ 1 *hour* *Outside of Class Time*: ≈ 1 *hour*	Some ideas presented include: - Mass media campaign focused on diversity and inclusion. - School-based violence intervention programming for youth and caregivers. - Trauma-informed. antiracist, and vicarious trauma training for first responders.	- Developed public health practice and critical thinking skills. • **Evidence-based approaches to public health** - Applied their current, potentially limited knowledge of the issue to begin problem-solving. • **Evidence-based approaches to public health**	- Offered areas of innovation that helped the Agency clarify its target audience for the intervention.
Assignment 1: Literature Review ***Submission***: *Group* ***Format***: *Written* ***Length***: 30 *pages* ***Description***: *Conduct a community assessment and literature review using the social-ecological model* (*SEM*) *to find evidence-based interventions* ***Attachments***: *Performance objectives, behavioral change objectives, and environmental change objectives* 2 *In-Class Time*: ≈ 3 hours *Outside of Class Time*: ≈ 15 hours	- Each student was responsible for examining the current evidence-based interventions to respond to community trauma for an assigned level of the SEM framework. - Students submitted a combined written proposal describing the current literature on community trauma.	- Utilized information literacy skills to identify the relevant literature, gauge their legitimacy, and appropriately cite the authorship. • **Evidence-based approaches to public health** - Synthesized information accurately for the Agency to understand the community impacts of the interventions and evaluate potential limitations of the interventions. • **Communication**	- Educated the Agency about best practices from the literature to respond to community trauma. - Informed a future grant application for funding to support expanding services in the community.

Continued

Oral Pitch: Intervention Options ***Submission***: *Group* ***Format***: *Oral* ***Length***: 15 minutes ***Description***: *During a virtual meeting with the Agency, students present three evidence-based options for interventions to address community trauma* ***Attachments***: *Visual presentation; PowerPoint slide deck* *In-Class Time*: ≈ 1 hours *Outside of Class Time*: ≈ 5 hours	- Students adapted their written Assignment 1: Literature Review into an oral presentation with 3 proposed intervention options for the Agency. - The student consulting team used an evidence-based framework to present their performance objective (*i.e.*, intervention objective) and 3 proposed interventions: - Performance Objective: Youth in the community will alleviate their trauma experienced by adverse events through engaging with community-based programming focused on trauma-informed care. - Three Proposed Interventions: 1) An Emergency Preparedness Plan 2) Youth Advocate Training Program 3) A Youth-Led Community Project	- Scheduled project milestones to meet internal and external deadlines supported by a team communication plan. • **Leadership** - Engaged in a hybrid environment that facilitated professional communication with the Agency. • **Interprofessional and Intersectoral Practice** - Communicated using audience-appropriate public health language to present their initial research findings and proposed solutions. • **Communication** - Conducted a needs assessment and integrated feedback from the Agency to adapt their programming for the community. • **Planning & Management to Promote Health**	- Provided intervention options for the Agency that were later implemented to address community trauma.
Assignment 2: Intervention Plan ***Submission***: *Group* ***Format***: *Written* ***Length***: 30 *pages with appendices* ***Description***: Students created an intervention focused on the public health issue for the Agency ***Attachments***: *Performance objectives, timeline, logic model, budget, and related intervention products, including youth advocacy curriculum lesson plans* *In-Class Time*: ≈ 4 hours *Outside of Class Time*: ≈ 40 hours	- The student consulting team provided the Agency with a fully developed evidence-informed two-week Youth Leadership and Advocacy curriculum called Youth A.C.T. - This curriculum centered an anti-racist, trauma-informed framework to provide youth participants skills to create community change. - The curriculum included hands-on activities, discussion questions, and intentional engagement with community stakeholders to build positive youth-adult relationships.	- Prioritized various tasks within this project to produce multiple deliverables in a timely fashion. • **Leadership** - Designed an intervention informed by the community's values to connect stakeholders to improve health outcomes for the community. • **Policy in Public Health** - Analyzed the community's current resources to budget for the proposed intervention. • **Planning & Management to Promote Health**	- An adapted version of the intervention is currently being implemented at a local youth agency that partners with the Agency.

Continued

Assignment 3: Communication Plan ***Submission***: *Individual* ***Format***: 5 *different media executions* (*i.e.*, *print*, *media*, *multi-media*) ***Length***: *Various* ***Description***: *Students develop individual media executions to promote the intervention in the community. Students decide which five executions best support the intervention* (*i.e.*, *press releases*, *editorial*, *podcasts*, *websites*, *videos*, *social media*, *press events*, *texting applications*, *etc.).* ***Attachments***: *Podcast script, press release, website wireframe, grant applications, and mass media campaign.* *In-Class Time*: ≈ 1 hour *Outside of Class Time*: ≈ 10 hours	The individual media executions included: - Two submissions for grant applications totaling $50,000 to support the program's community implementation. - A website designed as a template for intervention resources and community awareness. - A youth-led podcast about self-care, community advocacy, and antiracism.	- Selected effective communication strategies to support their intervention. • **Communication** - Expanded technological fluency through engagement with new communication platforms to reach their audiences. • **Systems Thinking**	- Awarded $50,000 in grants to support community trauma intervention programming. - Exposed the Agency to new tools in visual communication and ways to strategically engage a multigenerational community.
Assignment 4: Final Presentation ***Submission***: *Group* ***Format***: *Oral* ***Length***: **30** *minutes* (*presentations and questions*) ***Description***: Students present their final intervention design in a 20-minute presentation to the Agency, including a cohesive communication plan to support its success ***Attachments***: *Visual presentation*; *PowerPoint slide deck* *In-Class Time*: ≈ 1 hour *Outside of Class Time*: ≈ 5 hours	- The final presentation served as a culmination of the three course assignments. - The student consulting team received final feedback from the Agency and the supervising faculty as part of their final proposal development.	- Created a visually appealing and succinct proposal to present to the Agency. • **Evidence-based approaches to public health** - Coordinated the presentation with each team member to ensure harmonious delivery. • **Leadership** - Responded to feedback and questions from the Agency during the presentation. • **Interprofessional and Intersectoral Practice**	- Developed an ongoing academic community partnership to conduct a formative evaluation for the proposed intervention.

[1]The Council on Education for Public Health (CEPH) recognizes 8 fundamental MPH core competencies with a subset of 21 competencies. Each workforce skill includes its related fundamental competency in bold. Source: MPH Foundational Competencies, https://media.ceph.org/documents/D2_guidance.pdf. [2]These objectives are created based on the Intervention Mapping framework. Source: Bartholomew LK, Parcel GS, Kok G. Intervention mapping: A process for developing theory and evidence-based health education programs. Health Education & Behavior. 1998; 25(5): 545-63. https://doi.org/10.1177/109019819802500502.

Step 1: *Securing Partnerships*

A reciprocal collaboration for a successful PBT partnership necessitates the

PHA's issue area to align with course competencies. In return, the time investment from the PHA results in products tailored to their community. One month before the semester, partners set clear expectations regarding time commitment, engagement, and communication. These expectations are reiterated in writing (*i.e.*, syllabus, detailed assignment guidelines, course timeline). Faculty can find collaborating PHAs through SPH connections, alums, previous PHA referrals, and colleague referrals.

The partnership with the Agency for the Fall 2021 semester was established through an initial meeting at a national public health conference the year prior. Fall 2021 was not the first time the Agency participated in the course, but conversations about the new collaboration began in early Summer 2021 to address ideas for the Agency's issue area, due dates of deliverables and meetings schedules, the Agency's competing priorities, and community stakeholders for engagement throughout the semester.

The priority issue for the Agency was community trauma among its residents. Numerous communities faced the impacts of community trauma stemming from the COVID-19 pandemic and the recognition of long-standing systemic racism. In particular, the community served by the Agency reeled from the effects of a fatal hate crime in early 2021 that garnered national attention. While the Agency worked with local organizations to respond to the impacts of trauma, they recognized the need to build capacity and expand resources through external partnerships and community-engaged approaches. The charge to the students working with the Agency in Fall 2021 was to respond to the impacts of trauma manifesting in the community with an intervention designed to engage youth.

Step 2: *Technology and Training*

The PBT framework facilitates seamless collaboration with PHAs regardless of where they are geographically located. Effective PBT courses use technology to streamline communication, encourage active engagement, and integrate robust learning management systems (LMS). This course uses a web-based experiential learning platform as an LMS and collaboration space. The platform allows access to course materials (*i.e.*, readings, lectures, case studies) and the collaboration space encourages teamwork between PHAs, students, and faculty for real-time communication, document and feedback sharing, personal reflection, and peer review. Using technology, students also learn to explore creative solutions given limited resources. PBT classrooms can integrate expert guest lecturers to expose students and PHAs to often freely-available digital health and web-based platforms that support intervention implementation and communication.

The student team collaborated virtually with the Agency throughout the semester, increasing meeting flexibility while reducing travel time and exposing students to professionalism in a hybrid environment. Discussion boards were used throughout the semester for students to pitch ideas, the Agency to provide feedback on the student work products and interactions, and to document the process of deliverable development. The regularly scheduled virtual meetings ensured

final intervention deliverables were feasible and tailored to the community. The final deliverables for the community trauma project utilized various technologies such as video, audio, and visual editor software, wireframing, and product design tools. In addition to accessing technology for virtual collaboration, exposure to new technologies strengthened students' technical prowess while illustrating the potential for technology to enhance current and future programming in the Agency.

Step 3: *Engagement and Implementation*

Consistent communication among faculty, students, and PHAs, synergy within student teams, and ongoing opportunities for feedback are essential for the successful implementation of PBT courses. To support this, expectations reflect the demands of the current public health landscape by prioritizing timeliness, cultural responsiveness, and ingenuity. Student teams, typically representing various public health disciplines within the SPPH, as well as diverse experiences and student status (*i.e.*, part-time vs. full-time), create team agreements that resemble a work contract. These agreements specify group expectations and rules of engagement. Early course lectures and discussions cover professionalism and consultation techniques to support appropriate engagement with the PHA. Together this facilitates the development of harmonious deliverables representing the teams' strengths. Throughout the course, the teaching team compiles feedback from the PHA and the students to inform real-time adjustments to the pedagogy. This approach supports the teaching team in facilitating the needs of both the students and PHAs in a fast-paced learning environment. Subsequently, the teaching team conducts a comprehensive review of the feedback post-course to implement further improvements for future semesters.

The community trauma team communicated with identified community members through email, virtual, and in-person discussions. Members also conducted community site visits to assess the Agency's context of implementation. This level of engagement gave depth to the intervention and communication strategy made possible by the PBT course design. Each of the three course deliverables had multiple opportunities for feedback. Consequently, the final assignment for the Agency presented clear intervention ideas and specific strategies to address community trauma.

After each assignment, the community trauma team received feedback via a standardized form from the Agency on the deliverables' quality, the utility in practice, and the level to which it met field expectations. The feedback received from the Agency on the community trauma team project indicated that student assignments "met" the client's expectations. Students respond to the same question prompt when submitting the assignment, with student self-reported responses indicating they felt the deliverables "exceeded" the Agency's expectations. This discrepancy highlights an important point to students, signaling them to the high demands and expectations of the field. By integrating the Agency's feedback into the development of deliverables, the PBT framework ensures that the final

intervention is both relevant and impactful, aligning with the Agency's needs and encouraging students' abilities. Students also submitted self-reflections on their performance and that of their peers. The teaching team aggregated this feedback and reported back to student groups to offer areas for improvement and validation of successful collaboration processes.

Step 4: *Presenting Deliverables*

PBT courses ensure all assignments act as deliverables for the PHA to use in the field. Deliverables must be in formats that succinctly represents the shared vision of the intervention plan and communication strategy. Oral presentations of the final interventions include a question-and-answer session where students offer insight into the products' implementation. During this time, students demonstrate more advanced deliverables, including mobile apps, videos, website designs, and other technologies, and describe traditional written project proposals or grant applications. The presentation with the PHA allows students to practice professional presentation skills, which are essential in today's workforce.

The community trauma team designed an evidence-informed youth leadership and advocacy curriculum. The curriculum included newly developed resources and publicly available materials. It outlined daily objectives and activities to engage youth in anti-racist activism, trauma-informed strategies, and leadership skill building [30]-[32]. The curriculum intentionally engaged multiple community stakeholders to promote healthy youth-adult relationships, offer mentorship, and elevate youth power within the community. The final proposal included a budget, a three-year project timeline, a logic model, and a strategic communication plan. The communication plan addressed participant recruitment, appealed to funders and adopters, established community trauma norms, promoted the program to the community, and fostered interagency collaboration.

Step 5: *Sizing Up Results*

Continual evaluation of the pedagogy is important for resource allocation and curriculum improvement [20]. Teaching evaluations are not enough to provide the whole picture of the effectiveness of PBT; other assessment methods are essential [33]-[35]. Rarely, are the experiences of the PHA assessed, the application of student skills longitudinally tracked, and utility of practice products examined post-semester. The following data presents aggregated findings for the outcomes of the Fall 2021 semesters for all students. This data was collected via anonymous survey and cannot be stratified by student groups.

The Fall 2021 semester was evaluated using a variety of methods that went beyond the usual student course evaluations to examine the effectiveness of outcomes for all PBT stakeholders. This was part of a larger semester-long evaluation with the results specific to this case study highlighted here and results of the pedagogy, including a mixed-methods cross-discipline evaluation, published elsewhere [20]. Outcomes were assessed according to the course logic model and an independent evaluator conducted the evaluation [20]. The University's Institutional Review Board (IRB Number #H-37484) approved all activities as an exempt

study. The evaluation of student learning included: 1) course documents to provide course context and develop surveys; 2) post-assignment peer evaluations to assess the quality of group interactions; 3) pre-course (first week of class) and post-course (last week of class) surveys to assess achievement of competencies, satisfaction, and perceptions of PBT using a 5-point Likert Scale (strongly agree to strongly disagree or extremely important to not important); 4) grading rubrics to determine the range of grades in the semester; and, 5) the SPH student course evaluations to evaluate student reflections on the course, instructor, assignments, and activities. Data was analyzed according to qualitative and quantitative methods used in other PBT studies [20].

The students enrolled in the Fall 2021 semester (n = 24) completed a pre-course (n = 22) and post-course (n = 19) survey with 18 surveys matched at pre-test and post-test. Of the students responding to the pre-course survey, most respondents were female (90.91%, n = 20), aged 23 - 25 (54.55%, n = 12), and were full-time students (50%, n = 11) with minimal work experience (*data not shown*). Students reported a significant increase in the acquisition of skills that were the focus of the course from pre-course to post-course in all but one of the skill areas (giving presentations). The most significant skill increase occurred in consultation techniques and the primary competency areas of the course (**Table 2**). Additionally, post-course, students agreed that the time invested in taking a PBT course was worth it, more MPH courses should use PBT, and they appreciated the utility of the PBT course more post-semester than when they had initially enrolled (78%, n = 14) (**Table 2**). Students disagreed that they would have gained the same knowledge (83.33%) and the same skills (94.54%) if the course used traditional teaching methods rather than PBT (*data not shown*). Some skills were not significantly different with some reported slight decreases post-semester. This could be due to a ceiling effect with high pre-test scores, the pedagogical approach not impacting those skills, and/or perception of ability of those skills not fully realized at post-course [20].

Students reported that working with a PHA in a PBT course impacted their workforce readiness (**Table 2**) specifically by contributing to securing a position in the field and that PBT made them more marketable job candidates (4.37, std = 0.60), better prepared them to enter the workforce (4.00, std = 0.58), and enhanced their appreciation of public health practice (4.37, std = 0.76). In addition, students consistently agreed that PBT helped with skill development that is essential in the workforce, including problem-solving skills (4.21, std = 0.54), leadership skills (4.10, std = 0.74), teamwork skills (4.32 (0.67), and skills they could implement in their job (4.58, std = 0.51).

The Agency also reported post-course utility of the assignments, quality of collaboration, and satisfaction with the PBT course through course feedback gathered through informal meetings and a course survey administered to the Agency. In Fall 2021 the Agency reported implementing the deliverables produced by the students. The Agency stated that the intervention proposals (a course

Table 2. Skill acquisition and perceptions of practice-based teaching from pre-course to post-course in matched sample of students, Fall 2021, n = 18.

	Pre-Course[2] mean (std)	Post-Course[2] mean (std)	Mean Change	p-value
Skill Acquisition				
Please rate your current ability with regard to each of the following skills				
Consultation techniques	1.78 (0.81)	3.39 (0.98)	1.61 (1.09)	<0.0001
Conducting a literature review	3.50 (0.99)	4.22 (0.73)	0.72 (0.83)	0.0020
Development of performance objects	2.17 (0.99)	3.56 (1.15)	1.39 (1.14)	0.0003
Writing for the media	2.61 (1.10)	3.56 (1.04)	0.94 (1.06)	0.0039
Development of logic model	2.06 (0.94)	3.28 (0.83)	1.22 (0.73)	<0.0001
Design of communication plan	2.50 (1.15)	3.83 (0.86)	1.33 (1.28)	0.0009
Giving presentations	4.11 (0.83)	4.17 (0.99)	0.06 (0.87)	1.000
Design media executions	2.44 (1.15)	3.83 (0.79)	1.39 (1.24)	0.0002
Program evaluations	2.39 (0.78)	3.06 (1.06)	0.67 (0.91)	0.0137
Budget development	1.61 (0.70)	2.72 (0.83)	1.11 (1.02)	0.0010
Multi-media communication	2.28 (1.18)	3.44 (0.92)	1.17 (1.62)	0.0105
Perceptions of PBT				
I found working with a client through PBT…[1]				
Helped develop my problem-solving skills	4.33 (0.49)	4.22 (0.55)	−0.11 (0.47)	0.6250
Enhanced my leadership skills	4.28 (0.57)	4.11 (0.76)	−0.17 (0.51)	0.2750
Made me more marketable in my career	4.67 (0.49)	4.39 (0.61)	−0.28 (0.57)	0.1250
Allowed me to acquire skills I could implement in my job	4.56 (0.51)	4.61 (0.50)	0.06 (0.64)	1.000

Continued

Enhanced my skills working with a team	4.39 (0.50)	4.33 (0.69)	−0.06 (0.64)	1.000
Allowed me to acquire professional skills	4.72 (0.46)	4.50 (0.51)	−0.22 (0.2891)	0.2891
Enhanced my appreciation for the field of public health	4.44 (0.51)	4.39 (0.78)	−0.06 (0.80)	1.0000
Helped clarify my future plans	4.22 (0.88)	3.39 (0.92)	−0.83 (1.15)	0.0117
Was important in securing a practicum opportunity	3.61 (0.92)	2.56 (1.04)	−1.06 (1.26)	0.0035
Was important in securing a volunteer opportunity	3.89 (0.76)	2.39 (0.85)	−1.5 (0.99)	<0.0001
Made me better prepared to enter the workforce	4.50 (0.51)	4.06 (0.54)	−0.44 (0.62)	0.0156
Resulted in professional networking opportunities I might not have otherwise encountered	4.39 (0.50)	3.50 (0.86)	−0.89 (0.76)	0.0005
Enhanced my comprehension of the course content	4.17 (0.71)	4.06 (0.73)	−0.11 (0.68)	0.7266
Enhanced the quality of deliverables to the client	4.44 (0.51)	4.17 (0.71)	−0.28 (0.57)	0.1250

Footnotes: [1]Competencies listed map to the requirements of the course. [2]Response options ranged from "no familiarity" = 1; "some ability" = 2; "average ability" = 3; "above average ability" = 4; "very able" = 5. [3]p-values represent the comparison between pre/post are calculated at an alpha of 0.05 using the Wilcoxon Signed Rank Test.

deliverable) and collaboration/networking with faculty were the most beneficial aspects. Additionally, the Agency disagreed that it would be possible to develop

the same deliverables without added resources or gain the same quality of deliverables if they had produced them internally. The Agency strongly agreed that the time invested in PBT was worth it and would consider additional PBT participation in the future (*data not shown*). The Agency stated that more MPH courses should utilize PBT.

3. PBT Beyond the Classroom

A PBT course offers faculty, students, and PHAs opportunities to continue collaboration beyond the semester. The intensive nature of PBT coursework builds trust through mutually beneficial relationships while also increasing students' investment in emergent public health issues. Post-course, PHAs may seek more support in implementing the course deliverables, and faculty can continue building their professional portfolio by supporting student placements within PHAs.

The Agency, the faculty and a student from the community trauma team collaborated for almost two years beyond the semester. They partnered to 1) conduct a formative evaluation to understand needs and gaps in the community; 2) develop an intervention that merged the evaluation results with the intervention developed during the semester; and 3) secure funding and resources for intervention sustainability to address community trauma (Figure 2).

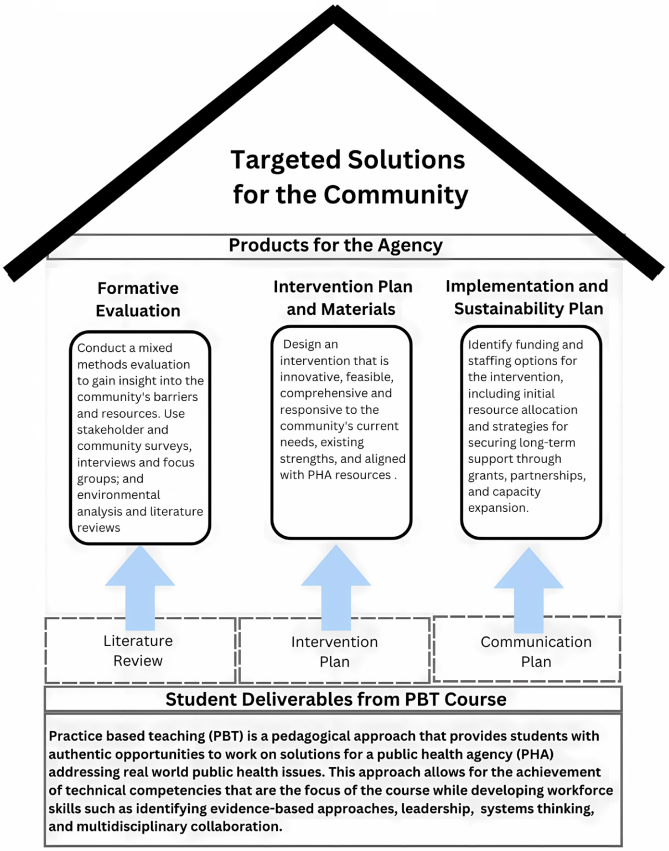

Figure 2. The use of practice-based teaching products as a foundation for long-term academic-community partnerships.

Pillar 1: *Formative Evaluation*

In Spring 2022, a student from the community trauma team continued to work with the Agency and faculty through a directed study to conduct an independent formative evaluation. Conducting a formative evaluation ensures resources are efficiently invested and that an intervention is appropriate for the target audience prior to program implementation [36] [37]. Formative evaluations are often too resource-intensive for PHAs to complete and are best conducted by an external researcher to facilitate unbiased community feedback. To further support the research, the faculty member secured an SPH-funded academic fellowship for an additional MPH student to provide quantitative analysis for a mixed-method evaluation design. This evaluation assessed the community's needs in a less time-constrained setting beyond the fourteen-week semester through surveys and interviews and focus groups. As a result of this evaluation process, the faculty and student team developed recommendations and feedback for the Agency to ensure efficient resource investment and appropriately modify the intervention designed during the PBT semester to maximize community impact [36] [37].

Pillar 2: *Intervention Plan*

The SPH team worked with the Agency to apply the evaluation findings using an intervention mapping framework to enhance the community trauma intervention developed during the course [38]. The PBT course intervention targeted community trauma through a youth-led intervention as informed by the Agency. However, after a more in-depth formative evaluation additional priority areas emerged including racial inequity, mental health concerns, substance misuse, increasing rates of domestic violence, and housing instability. In partnership with the Agency, the SPH team expanded the intervention's intended behavioral and environmental outcomes for the community [39]. Together, faculty and the Agency applied for local and federal funding for a wrap-around community service center. Some of these opportunities were funded, resulting in an infusion of resources into the community for implementation and continuation of research.

Pillar 3: *Sustainability*

Ongoing attention to complex public health issues, like community trauma, is crucial for understanding shifts in behavior and environmental factors. This helps identify resources, gaps in social, economic, and physical environments, and ultimately, the impacts on the community [40] and affords adopters and implementers the ability to sustain intervention efforts. After assessing the results of the formative evaluation, the Agency used a multidisciplinary approach to tackle community trauma through the creation of a cohesive infrastructure. Accordingly, the faculty and the Agency decided to conduct a more thorough evaluation of the disparate programming to inform a more system-level approach.

With the first research fellowship coming to an end, the faculty secured a second research fellowship to assist in the more extensive evaluation, particularly around community programming related to overdose prevention, intervention for domestic violence, and promoting youth mental health, issues that emerged in

the formative evaluation for community trauma. These efforts lead to additional funding and networks for hiring MPH graduates as full-time staff to implement the programming.

3.1. Stakeholder Benefits: The Agency, Faculty, and Students

In this case study, all stakeholders benefited from the collaboration beyond the PBT course. These benefits were uncovered through the evaluation process (public health agency), informal discussions (students and faculty), and formal interviews (public health agency, students, faculty). Benefits are described in detail below.

3.1.1. Public Health Agency Benefits

Through the formative evaluation, the Agency gained valuable insight into the most urgent needs of community members without utilizing their limited resources. The research helped the Agency refine its community trauma approach. Findings reinforced the need for a health equity framework to tackle the social factors contributing to the community's current traumas and stigmas. Without the pre-established relationship with the PBT course, the Agency would have spent considerable resources conducting the same research. The successes of this research created opportunities for the Agency and the SPH to continue to conduct high-quality research with limited resources.

As a result of the collaboration, the Agency was well-positioned to apply for, and receive in the year following the course collaboration, funding that increased resources and capacity of the Agency to better serve the community. The Agency received several multi-year grants from the state to address the impacts of domestic violence, with a focus on trauma recovery, housing stabilization, and training of current public safety and public health practitioners. These grants also allocate funds for the hiring of new staff positions within the Agency. Additionally, a federal grant supports the integration of data across the community's public health programs for real-time monitoring of trends. Collectively, these grants support sustainability and capacity within the Agency while strengthening connections among local agencies.

The Agency utilized a number of new tools through collaboration with the SPH, including written educational materials, research analysis software, and visualization tools that aid in communicating information to the community and beyond. The Agency and faculty disseminated their successful collaboration at multiple national conferences. This elevated the Agency's national status as a community trauma response and health equity leader and the SPH as an academic institution committed to linkages with the community. In 2022, federal agencies recognized the Agency as a mentor site to other LHDs across the U.S. interested in multi-sector approaches to public health. In this role, which continues presently, the Agency provides technical assistance and support to four other states to foster cross-institutional collaborations to address pressing community issues.

3.1.2. Student Benefits

The post-semester academic-community collaboration allowed the students working with the Agency to continue to refine their professional and research skills. Both students were fully engaged in the research process from Institutional Review Board (IRB) submission to the implementation of the mixed-method design. Guided by their own expertise and interests, the directed study student collected qualitative data through interviews, while the research fellow developed and analyzed quantitative surveys. Through peer collaboration, the students enhanced their respective skill sets. After some initial training, the faculty member supported the student researchers in leading the facilitation of interviews, completing qualitative data analysis through NVIVO coding sessions, aggregating the interview findings into recommendations for the Agency, and presenting the results to the Agency.

To support and sustain their research efforts post-PBT course, the directed study student received credit hours for the collaboration, and the research fellow received a standardized stipend through the school-based fellowship mechanism. Once the requirements of the directed study and fellowship ended, the students continued to work with the community-academic partnership in a volunteer capacity, given their investment in the work and motivation to see products from the collaboration. Faculty mentorship and partnership with the Agency enhanced students' individual skill sets, making them more marketable to employers [11] [12] [41] and the deliverables served as writing samples for the students to secure jobs after graduation. Partially due to their ongoing collaboration with the Agency, both students acquired supervisory public health roles. Currently, a research student continues to work as an evaluation consultant for the Agency with two new students who joined the SPH team to continue working with the Agency.

3.1.3. Faculty Benefits

While working with the Agency, the faculty benefited from a research environment that offered the potential for continued grant-funded opportunities. This is particularly important at the SPH, which relies on faculty securing their own funding. As an ongoing evaluator for the Agency, faculty built reputational capital for the SPH. The engagement of multiple students across the MPH program in this research advanced the faculty's individual reputation as an effective academic-community collaborator and resource for the SPH.

Due to the partnerships' success, the faculty was invited to present the PBT pedagogy at national academic and community institutions conferences. The presentation applied the PBT STEPS frameworks and highlighted the post-semester outcomes. This presentation yielded substantial interest in replicating the model in other academic institutions to address public health issues. Currently, faculty partners with colleagues to train on PBT implementation. The faculty continues to collaborate with the Agency as part of the PBT course and academic-community partnership. With this successful relationship, the faculty can improve the delivery of PBT coursework and use success stories to attract other

PHAs for collaboration, refine PBT course design and delivery, secure federal and local funding, and measure impact of these projects on communities.

3.2. Stakeholder Challenges

While the partnership between the faculty, student, and the Agency had substantial success during the PBT course and after with the continued academic-community partnership, as with any collaboration, partners had to navigate and overcome challenges. Some challenges that emerged throughout the follow-up period included timeline and resource constraints, barriers to implementing research into practice, and difficulties scaling the partnership. One key issue was the faculty, students', and the Agency's need to balance multiple priorities. For each stakeholder, the academic-community collaboration was only one facet of their professional or academic careers and required intentional investment and prioritization to support outcomes and with no earmarked time or financial support for the collaboration. The faculty and students operate on academic schedules, which often have breaks and periods of transitions built in, while the Agency often needed to maintain momentum on community research and initiatives. These mismatched timelines could contribute to gaps in progress. Due to the relatively short nature of graduate training (often 2 years or less) student turnover and career transitions also risk impacting the project's timeline. This places an increased burden on the faculty and students who engage with the Agency as long-term partners to preserve institutional knowledge of the partnership and onboard and train new students to support its continuation. Similarly, with the recognition of the success of the academic-community partnership the faculty and the Agency increasingly had to balance managing their regular workloads with increased demands from inquiries from other state agencies. This required the faculty and the Agency to manage stakeholder expectations for these new initiatives and partnerships that arose from the success of PBT.

The primary goal of the academic community partnership was to support the Agency in translating planning from the course and research from the formative evaluation findings into practice. However, due to limitations within the Agency such as staffing, training, stakeholder buy-in, and operations, the findings required the Agency to assess its internal capacity. The faculty and students supported the Agency during the transition period as they collaborated on program development efforts. This included facilitating focus groups, analyzing community surveys, and identifying sustainable funding sources while adjusting the final deliverables from the course to align with practical considerations and constraints. With the support of the faculty and students, the Agency was able to build capacity, obtain additional funding, and subsequently implement new interventions.

4. Discussion

The overview of PBT, its application to a recent case study, and the benefits experienced by all stakeholders offers a proven approach to educating students while

simultaneously contributing to public health's most immediate needs. Now more than ever, SPPH must prioritize students' education in practice-based skills to support the creation of a strong workforce pipeline seamlessly between academia and practice [41]. Considering increased demands and shifts in the public health landscape, a PBT course offers a vital solution to support the revitalization of a depleted public health workforce [42] [43].

PBT can be advantageous for agencies across various sectors; however, this case study shows the potential for tremendous impact, particularly on governmental public health such as LHDs. Due to the shortage of public health workers, LHDs are particularly impacted by competition from the private sector and lack of investment, making collaborations like PBT crucial for success [43]. With the implementation of PBT STEPS, students gain immediate workforce experience in the safety of the classroom setting as they connect with PHAs to tackle their communities' most pressing public health issues. This allows students to organically engage with required learning competencies such as applying systems thinking to a public health issue and communicating audience-appropriate content. These competencies are reflected in deliverables such as literature reviews, implementation pitches, and draft media executions to support the final intervention. Students are challenged to do this in an environment that reflects the demands of employers and challenges impacting the field.

Academic-community collaborations can fill gaps in the workforce as one-third of public health government employees report leaving the workforce in the immediate future due to retirement, low funding and salaries, burnout from responding to the pandemic, and other factors [3] [4] [44]-[46]. In 2021, the U.S. Department of Health and Human Services awarded $7.4 billion as part of the American Rescue Plan to support the public health workforce [47]. These resources, combined with an emphasis on PBT competencies in public health education through accreditation standards and a need to bolster the field with capable professionals, can strengthen the public health infrastructure [8].

Innovative pedagogical techniques like PBT are necessary as the public health workforce pivots in preparation for a post-COVID-19 era. This case study, reinforced with previous research, illustrates the utility of practice-based and academic-community approaches as a necessary avenue to respond to communities' immediate needs and impact workforce capacity. As illustrated by this case study, PBT offers tangible benefits for all stakeholders (PHA, students, faculty). The Agency gained a fully-designed and implementation-ready intervention, two students took on full-time employment in supervisory roles within governmental public health, and faculty found an ongoing partnership for future research efforts. It is these benefits that support the future of health, which relies on robust cross-sector collaborations like academic-community partnerships, to implement effective public health interventions, particularly by LHDs that are habitually under-resourced and overworked [13] [17] [48]-[50]. The PBT model uses a multidisciplinary approach that addresses resource and workforce gaps while allowing

students to apply their personal, professional, and academic experiences to the solution [50].

4.1. Limitations

There are some limitations of this case study. First, there are issues of generalizability. This was conducted on one small PHA with minimal hierarchical layers and results and beneficial outcomes may not be generalizable across all academic-community collaborations. In addition, this collaboration offers insights into the context of one large SPH within the specific framework of one MPH program's curriculum design. This potentially limits the case study's ability to capture the broader versatility of PBT, which extends beyond disciplinary confines and can be effectively employed across diverse programs and disciplines. While this case study presents some data on the long-term impacts of PBT on stakeholders, resource limitations prevented formal follow-up of outcomes and the inability to evaluate the sustained outcomes of the pedagogy for faculty, the Agency, and the students. In informal conversations, however, the Agency has reported using the deliverables for further program refinement and implementation and the students have reported the utility of the course and collaboration to success in the workforce.

In the ten years this course has been offered as a PBT course, however, and across a variety of PHAs, it is rare that the PHA, students, and faculty do not experience benefits of the collaboration beyond the 14-week semester. Second, the teaching team has been engaged in PBT for a long time and, over that time, has worked through some barriers and challenges to implementing PBT in the classroom. This experience, however, should not deter educators from considering PBT for their courses. The pedagogy is forever evolving with a foundation on real-time delivery, each semester bringing new collaboration and challenges. Finally, the case study represents a collaboration where the academic institution and PHA are in close geographic proximity, potentially supporting a successful and ongoing partnership. Over the almost three years of collaboration, all work except for one site visit has been done virtually highlighting the power of academic-community engagement in a virtual landscape.

4.2. Lessons Learned and Next Steps

Results of a PBT course vary depending on the topics addressed during the semester, the experience and background of the teaching team, the priorities of the PHA and the context of its community, and the level of investment of time and resources of the faculty. Each collaboration presents lessons learned that inform the establishment of future partnerships, course delivery, and sustainability of work post-semester. Some lessons learned from the establishment of the collaboration include defining clear goals and expectations for the community and its stakeholders, thoroughly reviewing the problem statement to ensure it meets course competencies, and streamlining engagement and communication processes.

During the course, touchpoints should be scheduled either in person or virtually to access PHA feedback toward tailored deliverables. Students should also be given multiple opportunities for feedback on their work to encourage a strong revise and resubmit process. Additionally, weekly email updates should be included across all stakeholders to keep them informed of the fluid nature of the course and expectations for upcoming classes. As illustrated by this case, sustainability of the work post-semester is possible and important. To ensure this, paid or credit-bearing opportunities should be created for students to continue working with the PHA. Post-semester meetings with the faculty and PHA should also be planned to assess needed resources and support to continue the work and how the faculty and SPPH can assist. Finally, student and PHA outcomes should be evaluated to redevelop and redesign the course for subsequent semesters. To add to this growing field of research, future examination of PBT should explore benefits and challenges in other disciplines using the pedagogy as well as longer-term outcomes for the PHA, faculty, alumni in the workforce, and the school, not just in graduate programs but undergraduate programs as well. Resources should be allocated to allow for longitudinal follow-up of outcomes for all stakeholders and to assess post-course outcomes including job readiness, intervention success for PHAs, and continued collaborations across partners. Strategic investment in such research will support increases in funding and capacity to redesign courses to be delivered with PBT and provide ongoing evaluation of the utility in practice.

As students graduate from public health programs and enter the workforce, there are continued concerns related to the undertraining of public health workers [43]. Assessments of current workforce needs indicate that skill gaps plague public health in resource management; forming and sustaining effective partnerships; implementing diversity, equity, and inclusion practices; and effectively communicating with internal and external stakeholders [42] [46]. These deficits in technical workplace skills align with core competency expectations that the Council on Education for Public Health (CEPH) requires for the accreditation of public health programs [8]-[11]. SPPH and faculty must support pedagogies that center these competencies and evaluate curriculum implementation to ensure the highest return on investment for students, faculty, and the field overall. Academic-community partnerships and PBT require investment from all stakeholders. However, the field demands that students and community partners enter the classroom to best prepare the next generation of the workforce. This investment is necessary to ensure the current and future workforce can respond to timely issues using innovation, collaboration, and immediate application.

5. Conclusion

The Agency and SPH team are one example of a successful PBT course in a series of many PBT success stories for any SPPH engaging in this pedagogy. The short-term course partnership turned academic-community collaboration addresses the current public health landscape, the depletion of the public health workforce given

its history and predicted gaps, the heightened attention to training public health students, and the increased need for innovative and flexible solutions to challenges faced by communities. The resource sharing between academic institutions and PHAs is a strategic endeavor to overcome limitations in public health infrastructure while simultaneously investing in the future public health workforce and equipping public health-serving agencies with the tools and evidence needed to solve challenges facing their communities.

Authors' Contributions

M.V., M.H., A.M., and J.A.G. conceptualized the study. M.V., S.C., and J.A.G. developed the study design. M.V., S.C., and D.C. facilitated data collection. A.C., D.M., A.F., and J.A.G. collaborated in data analysis. J.A.G., E.N., and M.V. drafted the initial manuscript. All authors edited and reviewed the manuscript.

Conflicts of Interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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