RUBRIC

Physics Teacher Education Program Analysis (PTEPA) Rubric

A rubric to describe and guide physics teacher education programs

The purpose of the Physics Teacher Education Program Analysis (PTEPA) Rubric is to characterize physics teacher education programs. The PTEPA Rubric emphasizes elements that have been observed in "thriving" physics teacher education programs (programs at large universities that typically graduate five or more physics teachers in a year). It is intended to provide programs with feedback, to guide programs in self-reflection toward improvement, and to provide a means to characterize and research program growth.

Further information about the PTEPA Rubric can be found at **phystec.org/THRIVING**.

We acknowledge funding from NSF-0808790 and APS's 21st Century Campaign for development of the PTEPA Rubric.
This work was conducted by Chasteen Educational Consulting and Scherr & Associates.

February 2018 | Version 1.0

Contents

Definitions of Terms Used in PTEPA Rubric *(in the order in which they appear)*

Physics teacher education (PTE) program Either the formal named physics teacher education program (e.g., UTeach) or the informal collection of (1) courses and experiential learning opportunities for teachers with physics-specific content and (2) people (instructors, leaders) who directly serve physics teacher candidates.

PTE program leaders Those faculty members (tenure or non-tenure track) or administrators in physics or science education (or similar unit responsible specifically for PTE) who spearhead the program, advocate for resources such as funding and personnel, and negotiate with the institution for changes beneficial to physics teacher education.

PTE program team A team consisting of the program leaders plus other personnel who are responsible for the daily operation of the PTE program.

Teacher in Residence A person with exemplary understanding of teaching and experience teaching in K–12 schools who functions as an essential colleague to the PTE program.

Early teaching experiences Those teaching experiences intended to give first- and second-year students experience with teaching, such as sustained tutoring, sustained outreach, Learning Assistant opportunities, and U-Teach "Step1" or other entry-level courses, among other possibilities.

Physics teacher candidate A student who has committed to completing a program of physics teacher education.

Physics pedagogy credits Credits earned either through (1) completing a standalone course devoted to physics teaching and learning, or (2) completing a science methods or other course that has a component about physics teaching and learning (in which case only a fraction of course credit is considered as physics pedagogy).

Science methods course A standalone course exploring techniques in science instruction, taught in the School of Education.

Field experience An in-classroom K–12 teaching experience for teacher candidates, preferably in a physics or physical-science classroom with an on-campus course component. The goal of a field experience is to put education coursework into practice in a school setting by teaching (or helping to teach) a pre-college class.

Student teaching A capstone field experience in which a teacher candidate teaches in a K–12 setting with full control of multiple classes for at least a semester, fulfilling licensure requirements.

Cooperating teacher A certified teacher (preferably a physics teacher) who hosts and supervises student teaching experiences at a school, as part of field experiences or student teaching.

University supervisor A member of the university faculty with expertise in teacher education who is the instructor of record for the student teaching experience, which includes observing and supporting teacher candidates during student teaching.

PTE mentor A faculty member who specializes in physics teacher education, a TIR, or a local teacher who is able to provide mentoring in careers, skills, and teaching development (not just academic advising).

Acronyms

A&S College of Arts & Sciences or equivalent
FTE Full-Time Equivalent
LA Learning Assistant
PTE Physics Teacher Education
SoE School of Education or equivalent
STEM Science, Technology, Engineering, and Mathematics
TA Teaching Assistant
TIR Teacher in Residence

PTEPA Rubric Item Definitions

NP Not present in the program.
Developing Program is making progress towards meeting a typical goal for this item.
Benchmark Program meets a typical goal for this item.
Exemplary Program goes well beyond a typical goal for this item.
Prevalent Majority of studied sites achieved benchmark level on the item.

Standard 1 Institutional Commitment

There is a strong institutional commitment to STEM teacher education, supported by policy, rewards, and financial resources.

	NP	Possible attributes at Developing Level	Possible attributes at Benchmark Level	Possible attributes at Exemplary Level

1A: Institutional Climate and Support

There is a strong institutional commitment to science, technology, engineering and math (STEM) teacher education, with physics teacher preparation as an explicit component.

	NP	Developing Level	Benchmark Level	Exemplary Level
1A-1 University-level support[1] for STEM education PREVALENT	☐	☐ President- or provost-level administration verbally prioritizes STEM educational improvements, but as yet there is little to no evidence of this support.	☐ Additionally, there is evidence of university support for STEM education improvements.	☐ There is concrete support from the university for STEM education improvements.
1A-2 Institutional mission of teacher education PREVALENT	☐	☐ The institutional mission and/or strategic priorities historically support teacher education.	☐ The institutional mission or strategic priorities are explicitly well aligned with teacher preparation (e.g., an emphasis on service).	☐ Institutional administrators emphasize publicly & consistently that teacher preparation is part of the core institutional mission and strategic priorities are explicitly well aligned with teacher preparation.
1A-3 Admistrative recognition for physics teacher education (PTE) program[2] PREVALENT	☐	☐ The PTE program has received modest recognition from administrators (e.g., department-level recognition, being mentioned in meetings).	☐ The PTE program has received significant public recognition from administrators (e.g., public remarks, campus newsletter, college website).	☐ The PTE program is a point of pride for the institution, and its work is publicly recognized in several venues.
1A-4 University–level support[1] for teacher education	☐	☐ President- or provost-level administration verbally prioritizes teacher education, but as yet there is little to no evidence of this support.	☐ Additionally, there is evidence of university administration support for teacher education.	☐ There is concrete support from the university administration for teacher education.
1A-5 Arts & Sciences (A&S)[3]–level support[1] for teacher education	☐	☐ The Dean of the College of A&S verbally prioritizes teacher education, but as yet there is little to no evidence of this support.	☐ Additionally, there is evidence of A&S support for teacher education.	☐ There is concrete support from A&S for teacher education.
1A-6 School of Education (SoE)[4]–level support[1] for physics teacher education	☐	☐ There is some evidence of SoE support for science teacher education.	☐ Additionally, there is some evidence of SoE support for physics teacher education.	☐ There is concrete support from the SoE for physics teacher education.

1B: Reward Structure

The institution encourages, supports, and rewards leadership in physics teacher preparation.

	NP	Developing Level	Benchmark Level	Exemplary Level
1B-1 Promotion and tenure in physics	☐	☐ At least one physics faculty member is given credit toward promotion based on their work in PTE.	☐ At least one physics faculty member has been hired in large part based on their PTE expertise.	☐ At least one tenure-track physics faculty member has been promoted in large part based on their PTE activities.
1B-2 Time for PTE program leaders[5] to engage	☐	☐ Physics teacher preparation is officially included as part of service for PTE program leader(s).	☐ PTE program leader(s) have received modest time to engage in PTE activities.[6]	☐ PTE program leader(s) have received significant time to engage in PTE activities.[6]
1B-3 Recognition for PTE program team[7]	☐	☐ Modest recognition[8] is provided to members of the PTE program team for engaging in PTE.	☐ Members of the PTE program team have been nominated for awards[9] during the past five years based on their PTE activities.	☐ The department or institution celebrates PTE activities through significant public recognition in the last three years.

Continued

Standard 1 Institutional Commitment

	NP	Possible attributes at Developing Level	Possible attributes at Benchmark Level	Possible attributes at Exemplary Level
1C: Resources				
The program and leadership team has sufficient resources to run.				
1C-1 **Engaged staff**[10] PREVALENT	☐	☐ Less than 0.5 full-time equivalent (FTE) engaged staff.	☐ 0.5–1.0 FTE engaged staff.	☐ More than 1 FTE engaged staff.
1C-2 **Institutional funding**[11] PREVALENT	☐	☐ Institutional funding is at least $5K.	☐ Institutional funding is $25K–$100K/year.	☐ Institutional funding exceeds $100K/year.
1C-3 **External funding** PREVALENT	☐	☐ External funding is less than $25K/year.	☐ External funding is $25K–$100K/year.	☐ External funding exceeds $100K/year.
1C-4 **Stability of program operational funding**[12]	☐	☐ Operational funding has been historically granted but occurs on a year-to-year basis.	☐ Operational funding is guaranteed for at least three years.	☐ Operational funding is a recurring line item or is supported by ongoing endowments.
1C-5 **Program space**	☐	☐ The program is housed in a faculty office with a clear program label.	☐ The program has a dedicated space.	☐ The program has dedicated space in a location frequented by physics students.

[1] **Evidence of support for education** (STEM, teacher, or physics teacher) could encompass regular inclusion in strategic planning, public declarations of need for programs or educational change, verbal protection of the program, inclusion in or strong alignment with an explicit mission statement, a long-term plan, the School of Education (SoE) providing a science licensure program, and so on. Concrete support includes policies, funding and/or space for programs, positions, an institute, and the like.

[2] The **Physics teacher education (PTE) program** is either the formal named physics teacher education program (e.g., UTeach) or the informal collection of (1) courses and experiential learning opportunities for teachers with physics-specific content and (2) people (instructors, leaders) who directly serve physics teacher candidates. The program should include a presence in the physics department but need not be run out of the physics department.

[3] **Arts & Sciences (A&S)** or other academic unit that includes physics and other related disciplinary departments.

[4] **School of Education (SoE)** or other academic unit that is charged with teacher education.

[5] **PTE program leaders** (also called champions) are those faculty members (tenure or non-tenure track) or administrators in physics or science education (or similar unit responsible specifically for PTE) who spearhead the program, advocate for resources such as funding and personnel, and negotiate with the institution for changes beneficial to physics teacher education.

[6] **Modest time to engage** includes summer salary, time release, or other support. **Significant time to engage** includes course load modifications, PTE courses included in teaching load, or inclusion of PTE activities in regular duties.

[7] The **PTE program team** consists of the program leaders plus other personnel who are responsible for the daily operation of the PTE program.

[8] **Modest recognitions** include a thank-you letter, a notice in the departmental newsletter, or broad recognition for educational activities but not specific recognition for PTE.

[9] **Awards** may be institutional or external, as long as the nomination is initiated locally (e.g., within the department or institution).

[10] **Engaged staff** include non-faculty administrative or other staff who support the program, including Teachers in Residence. Staff may include those funded on external grants.

[11] **Institutional funding** can include the portion of site leaders' salaries dedicated to PTE (beyond their normal duties), recruitment activities, Learning Assistant programs, scholarships, a Teacher in Residence, curricular design or reform, Teacher Advisory Groups, or other resources supporting PTE. Except in rare cases, do NOT count the portion of site leaders' or team members' salaries which can be considered part of normal duties (even if they serve physics teacher candidates) such as physics faculty teaching an introductory physics course or advising majors or education faculty teaching a science methods course).

[12] **Operational funding** can be internal or external funding and is the specifically dedicated funding required for the program to run successfully (as defined by the program leader), such as funding for a Teacher in Residence or Learning Assistance program. Except in rare cases, faculty salary would not be included, as this does not require dedication of PTE-focused funding.

Standard 2 Leadership and Collaboration

The program has an effective leadership team, including effective collaboration between physics and education.

	NP	Possible attributes at Developing Level	Possible attributes at Benchmark Level	Possible attributes at Exemplary Level

2A: Program Team Members

The program consists of a team[1,2] whose members are in positions that enable effective leadership.

	NP	Developing Level	Benchmark Level	Exemplary Level
2A-1 **PTE program leaders[1]** PREVALENT	☐	☐ Program leaders include at least one faculty member.	☐ Program leaders include two faculty members.	☐ Program leaders include three or more faculty members.
2A-2 **PTE program team[2]** PREVALENT	☐	☐ Team consists of one person in addition to the leader(s).	☐ Team consists of two people in addition to the leader(s).	☐ Team consists of at least two people in addition to the leader(s), at least one of whom is a faculty member.
2A-3 **Teacher in Residence (TIR)[3]** PREVALENT	☐	☐ There is a part-time physics TIR, or there is a science TIR (at any FTE).	☐ There is one FTE physics TIR.	☐ There is more than one FTE physics TIR.
2A-4 **Teacher Advisory Group (TAG)[4]**	☐	☐ There is a science TAG.	☐ There is a physics TAG (significant physics teacher membership).	☐ There is a physics TAG that is readily available for consultation by the PTE team.

2B: Program Team Attributes

The PTE program consists of a team[1,2] whose expertise, identity, and activities strengthen the program.

	NP	Developing Level	Benchmark Level	Exemplary Level
2B-1 **Common vision among the PTE program team[1,2]** PREVALENT	☐	☐ The team is not hampered by fundamental disagreements about PTE.	☐ The team shares a common vision for excellence in PTE.	☐ The team's common vision for PTE is explicitly stated (e.g., in a mission statement for the program).
2B-2 **Positional power** PREVALENT	☐	☐ One member of the team is tenured.	☐ One member of the team holds positional power in the department (e.g., chair, undergraduate chair).	☐ The team has at least one member with positional power and at least one other tenured member.
2B-3 **Disciplinary expertise** PREVALENT	☐	☐ The team includes a member with expertise in physics and a member with expertise in education.	☐ The team includes a member with expertise in physics education.	☐ The team includes multiple members with expertise in physics education, some with primarily physics expertise and some with primarily education expertise.
2B-4 **Personal motivation to improve PTE** PREVALENT	☐	☐ One team member is moderately motivated to improve PTE.	☐ One team member is strongly motivated to improve PTE.	☐ Multiple team members are motivated to improve PTE.
2B-5 **Integration of Teacher in Residence (TIR)** PREVALENT	☐	☐ The TIR interacts frequently with teacher candidates.	☐ The TIR interacts with teacher candidates in more than one venue and engages in at least one other recommended TIR activity.[5]	☐ The TIR is deeply integrated in the program, intersecting with teacher candidates and faculty in multiple settings, and engages in at least two other recommended TIR activities.[5]

Continued

Standard 2 Leadership and Collaboration

	NP	Possible attributes at Developing Level	Possible attributes at Benchmark Level	Possible attributes at Exemplary Level
2B-6 K–12 school engagement PREVALENT	☐	☐ At least one member of the team has K–12 experience.	☐ At least one member of the team is regularly engaged with local schools or school districts.	☐ Multiple members of the team are regularly engaged with local schools or school districts.
2B-7 Physics Education Research (PER) expertise PREVALENT	☐	☐ Team has members that are somewhat familiar with PER.	☐ Team members are very familiar with and use PER practices in their instruction.	☐ Team members are active in the PER community through regular journal reading or conference attendance.
2B-8 Professional engagement in PTE PREVALENT	☐	☐ At least one team member is a member of PhysTEC or similar STEM teacher education organization.	☐ At least one team member regularly attends PhysTEC or similar STEM teacher education conference.	☐ At least one team member has led a session at PhysTEC or similar STEM teacher education organization.
2B-9 Reputation of PTE program team	☐	☐ At least one team member has successfully created change at some level in their institution.	☐ At least one team member has successfully created or substantially modified a new program at their institution.	☐ At least one team member is recognized at their institution as an opinion leader and has a record of creating institutional change.

2C: Program Collaboration

The program includes effective collaboration between the academic unit housing the physics teacher education program (such as physics) and other academic units that control teacher certification (such as education).

2C-1 Communication across units on PTE program elements[6] PREVALENT	☐	☐ There are occasional interactions between units on PTE program elements.	☐ There are as-needed meetings or presentations between units on PTE program elements.	☐ There are regular meetings between units to address any issues related to PTE program elements, and all related units participate in program accreditation activities.
2C-2 Negotiated roles between units PREVALENT	☐	☐ The different academic units involved in PTE do not hinder one another's efforts.	☐ Regular practices have been established that guide interactions with other academic units regarding the PTE program.	☐ There is a functional negotiated agreement among the different academic units involved in PTE, including dean-level involvement.
2C-3 Boundary crossers[7] PREVALENT	☐	☐ One part-time team member is a boundary crosser.	☐ One full-time team member is a boundary crosser.	☐ More than one full-time team member is a boundary crosser.
2C-4 Curriculum development between units PREVALENT	☐	☐ Physics and education are independently involved in curriculum development for PTE.	☐ There are regular meetings between disciplinary and education faculty to discuss PTE curriculum.	☐ Mutual collaboration between physics and education has resulted in a cohesive curriculum, which includes physics content relevancy in essentially all licensure courses.
2C-5 Departmental representation	☐	☐ The PTE team includes faculty in physics or education, with informal contacts in the other department.	☐ The PTE team includes faculty in both physics and education departments.	☐ PTE program leaders include faculty in both physics and education departments.

Continued

Standard 2 Leadership and Collaboration

	NP	Possible attributes at Developing Level	Possible attributes at Benchmark Level	Possible attributes at Exemplary Level
2C-6 Collaboration on student advising	☐	☐ There are informal connections between faculty in physics and education to address student advising questions.	☐ There are regular cross-department meetings to discuss student progress.	☐ There are formal cross-departmental structures to provide discipline-specific advising to physics teacher candidates.
2C-7 Collaboration with PTE mentor[8] on student teacher placement	☐	☐ The primary PTE mentor is aware of where PTE candidates are placed.	☐ The primary PTE mentor's feedback is considered during PTE candidate placement.	☐ The primary PTE mentor significantly influences PTE candidate placement.
2C-8 Cohesiveness of student experience	☐	☐ Students view the physics degree and licensure requirements as two separate programs that are designed to be taken together.	☐ Students view the physics degree and licensure requirements as a single program, but with different expectations and philosophies within each unit.	☐ Students view the physics degree and licensure requirements as a single program with one set of requirements and consistent expectations and philosophies.

[1] **PTE program leaders** (also called champions) are those faculty members (tenure or non-tenure track) or administrators in physics or science education (or similar unit responsible specifically for PTE) who spearhead the program, advocate for resources such as funding and personnel, and negotiate with the institution for changes beneficial to physics teacher education.

[2] The **PTE program team** consists of the faculty leaders and other personnel who are responsible for the daily operation of the PTE program.

[3] A **Teacher in Residence** (TIR) is a person with exemplary understanding of teaching and experience teaching in K–12 schools who functions as an essential colleague to the PTE program. A science TIR has a strong science background and K–12 science teaching experience. A physics TIR has a strong physics background and K–12 physics teaching experience.

[4] A **Teacher Advisory Group** (TAG) is a group of local physics teachers that meet regularly with the PTE team to help improve pre-service teacher education and network with teacher candidates.

[5] **TIR recommended activities** include: Recruit candidates, work with LA programs, mentor teacher candidates, partner with local teachers, organize TAG meetings, solicit feedback from program participants and graduates, hold regular meetings with faculty leaders, teach or co-teach science methods courses, organize and mentor candidates in field experiences, develop assessment plans for the program, observe and mentor recent graduates, and more (see for example Plisch et al., *The PhysTEC Teacher in Residence*, in C. Sandifer and E. Brewe, *Recruiting and Educating Future Physics Teachers*, American Physical Society, 2015).

[6] **PTE program elements** could include students, curriculum, placement, instructor assignments, or advising.

[7] **Boundary crossers** are people who have activities in both the academic unit housing the physics teacher education program (e.g., physics, education) and another unit involved with physics teacher education, such as joint appointment, co-teaching, research collaboration, or significant committee service.

[8] A **PTE mentor** is a faculty member who specializes in physics teacher education, a TIR, or a local teacher who is able to provide mentoring in careers, skills, and teaching development (not just academic advising).

Standard 3 Recruitment

The program recruits many physics teacher candidates by taking advantage of local opportunities and offering attractive options for participation.

	NP	Possible attributes at Developing Level	Possible attributes at Benchmark Level	Possible attributes at Exemplary Level
3A: Recruitment Opportunities				
The program has access to a pool of potential teacher candidates.				
3A-1 **Physics majors**[1] PREVALENT	☐	☐ The number of physics majors is in 2nd national quartile (3–4/year B.S. programs; 8–13/year PhD programs).	☐ The number of physics majors is in 3rd national quartile (5–8/year B.S.; 14–24/year PhD).	☐ The number of physics majors is in 4th national quartile (9+/year B.S.; 25+/year PhD).
3A-2 **Physics-aligned majors**[2] PREVALENT	☐	☐ There is a pool of physics-aligned majors that is equal to the number of physics majors.	☐ There is a pool of physics-aligned majors that is two to four times the number of physics majors.	☐ There is a pool of physics-aligned majors that is at least five times the number of physics majors.
3A-3 **Recruitment network**	☐	☐ At least one physics faculty actively refers interested students to the PTE program.	☐ Essentially all physics faculty actively refer interested students to the PTE program.	☐ In addition to physics, one to two other units or programs actively refer interested students to the PTE program.
3A-4 **Program identity and reputation**	☐	☐ The program has a name.	☐ The program has moderate identity and reputation (e.g., brochures, logo, local knowledge of the program).	☐ The program has strong identity and reputation (e.g., developed branding, website, regional or national reputation).
3B: Recruitment Activities				
The program actively recruits physics teacher candidates.				
3B-1 **Program promotion**[3] PREVALENT	☐	☐ There is minimal program promotion (1–2 practices).	☐ There is modest program promotion (3–4 practices).	☐ There is substantial program promotion (5+ practices).
3B-2 **Physics teaching advisor** PREVALENT	☐	☐ At least one person in physics can share a viable path to earning licensure.	☐ One person in physics can share in detail the options for becoming a physics teacher.	☐ Two or more people in physics can share in detail the options for becoming a physics teacher.
3B-3 **Physics teaching ambassador** PREVALENT	☐	☐ Potential PTE candidates are exposed to a positive ambassador for science teaching professions.	☐ Potential PTE candidates are exposed to a positive ambassador for the physics teaching profession.	☐ Potential PTE candidates are exposed to a positive ambassador for the physics teaching profession who has K–12 teaching experience.
3B-4 **Accurate information about career benefits**[4] **of teaching**	☐	☐ The PTE program shares accurate information about financial compensation for teachers in the U.S.	☐ The PTE program shares accurate information about financial compensation for teachers in the U.S., as well as at least two less commonly known advantages of the profession.	☐ The PTE program shares accurate information about financial compensation for teachers, including detail for local school districts, as well as at least two less commonly known advantages of the position.
3B-5 **Physics climate toward teaching as a career**	☐	☐ Physics faculty discuss teaching as a career as a viable option for physics students.	☐ Teaching careers are discussed within physics as a normative career choice (e.g., on equal weight with academic or industrial careers).	☐ Teaching as a career is widely celebrated in the department (e.g., through awards, recognition, or positive enthusiasm).

[1] **Numbers of physics majors** can be determined using data at www.aps.org/programs/education/statistics/compare.cfm

[2] **Physics-aligned majors** are majors with enough physics content knowledge to constitute a minor in physics (e.g. astronomy, mechanical engineering, electrical engineering, etc.). It's best to evaluate according to the topics covered in coursework for each major.

[3] **Program promotion** may include marketing of the program itself OR marketing of early teaching experiences that primarily feed into the program (such as an LA program from which there is significant recruitment) in a way that reaches the target audience of potential physics teachers. Marketing practices may include announcements in introductory courses, announcements at first-year student orientation, outreach events, a table at career fairs, advertising materials (flyers, brochures, postcards, promotional products, bus advertisements), letters to students (incoming students or continuing students), announcements (in campus newsletters, email lists, etc.). Any one of these counts as a practice.

	NP	Possible attributes at Developing Level	Possible attributes at Benchmark Level	Possible attributes at Exemplary Level

3C: Early Teaching Experiences for Recruiting Teacher Candidates

Early teaching experiences[5] give first- or second-year students a taste of the rewards and challenges of teaching.

3C-1 **Attractiveness of early teaching experiences[5]** PREVALENT	☐	☐ Early teaching experiences are somewhat attractive to physics students (e.g., some physics content but includes cost or extra time to participate).	☐ Early teaching experiences are attractive to physics students (e.g., high physics content, time-efficient, free, or course credit).	☐ Early teaching experiences are very attractive to physics students (e.g., high physics content, paid, or other incentives to participate).
3C-2 **Exposure to intellectual challenge of teaching** PREVALENT	☐	☐ Students participating in early teaching experiences receive informal mentorship in teaching.	☐ Students participating in early teaching experiences learn about teaching as a rigorous intellectual endeavor.	☐ Students participating in early teaching experiences are exposed to physics education research and/or the scholarship of teaching.
3C-3 **Availability of early teaching experiences[5]**	☐	☐ Early teaching experiences accommodate the number of physics students who typically enter the certification program.	☐ Early teaching experiences accommodate at least twice the number of physics students who enter the certification program.	☐ Early teaching experiences can accommodate several times the number of physics students who enter the certification program.
3C-4 **Recruitment within early teaching experiences[5]**	☐	☐ Students participating in early teaching experiences are informed at least once about the PTE program and opportunities in the teaching profession.	☐ Students participating in early teaching experiences are informed about the PTE program and encouraged, as a group, to consider teaching as a career.	☐ Students participating in early teaching experiences are individually encouraged and assisted in taking the next steps toward a teaching career.
3C-5 **Exposure to K–12 teaching environments**	☐	☐ Early teaching experiences have some exposure to 4th–12th grade teaching environments or students.	☐ Early teaching experiences occur primarily in 4th–12th grade teaching environments or students.	☐ Early teaching experiences occur in 4th–12th grade teaching environments or students, with a physics or physical science focus.

3D: Streamlined and Accessible Program Options

The teacher education program provides a variety of options for physics and related majors to complete the program without unduly extending their undergraduate career or taking on financial burdens.

3D-1 **Time to undergraduate degree plus certification[6]** PREVALENT	☐	☐ A physics major will require five years or less to complete the program.	☐ A physics major will likely require five years or less to complete the program if they start as a junior.	☐ Most physics majors can complete the program within their four-year degree if they start as a junior.
3D-2 **Streamlined undergraduate teaching track in physics** PREVALENT	☐	☐ The physics program allows some teaching credits to count toward physics degree requirement (e.g., electives or humanities requirements).	☐ The physics program offers a physics teaching minor that leads to certification.	☐ The physics program offers a teaching track or concentration that is well designed and streamlined to integrate with certification requirements.
3D-3 **Post-baccalaureate certification[6]**	☐	☐ There is a post-baccalaureate option that will take four semesters to complete.	☐ There is a post-baccalaureate option that will take one year to complete.	☐ There is a post-baccalaureate option that takes one year or less to complete, and there is a part-time coursework option.
3D-4 **Certification credits count toward master's degree**	☐	☐ Six or more post-baccalaureate credits count toward a master's degree.	☐ 15 or more post-baccalaureate credits count toward a master's degree.	☐ Compact (30 credit) master's degree available to students upon completion of certification.
3D-5 **Financial support for physics teacher candidates**	☐	☐ Substantial financial support (at least half the cost of attendance) is made available to 1–2 PTE candidates, OR several smaller financial support options are available to many students.	☐ Substantial financial support is made available to >25% of the PTE candidates.	☐ Substantial financial support is made available to >50% of the PTE candidates.

[4] **Career benefits** include the following: (1) **Financial benefits**, such as accurate salary information, desirable retirement benefits, student loan forgiveness programs, scholarships, and opportunities for supplementary income. Many of these benefits are typically underestimated (including salary). (2) **Other advantages**, which are less commonly known, such as high intellectual challenge, high overall job satisfaction, opportunities for ongoing scientific professional development, easy job placement, and geographic mobility due to high demand for teachers. These advantages are greater in the teaching profession than in other STEM professional fields. See www.aps.org/units/fed/newsletters/fall2017/survey.cfm for more information.

[5] **Early teaching experiences** are those teaching experiences intended to give first- and second-year students experience with teaching, such as sustained tutoring, sustained outreach, Learning Assistant opportunities, and U-Teach Step1 or other entry-level courses, among other possibilities. Experiences intended to develop the teaching practice (such as student teaching) are documented elsewhere (see Standard 4, Components 4C and 4D).

[6] **Undergraduate or post-baccalaureate certification**: If the program does not include one of these options, leave that item blank.

Standard 4 Knowledge and Skills for Teaching Physics

The program ensures that teacher candidates are well prepared to teach physics effectively.

	NP	Possible attributes at Developing Level	Possible attributes at Benchmark Level	Possible attributes at Exemplary Level
4A: Physics Content Knowledge				
The program ensures that teacher candidates have strong physics knowledge.				
4A-1 **Physics degree for physics teacher candidates[1]** PREVALENT	☐	☐ Most physics teacher candidates complete a physics minor or equivalent, but it is not required.	☐ A physics minor or equivalent is required for physics teacher candidates.	☐ Essentially all physics teacher candidates complete a physics major or equivalent (which may or may not be required).
4A-2 **Introductory course pedagogy**	☐	☐ A minority of majors' introductory physics course experiences are with research-based teaching methods.	☐ At least half of majors' introductory physics course experiences are with research-based teaching methods.	☐ Almost all of majors' introductory physics course experiences are with research-based teaching methods.
4A-3 **Student research for teacher candidates**	☐	☐ There is an optional research experience available to teacher candidates.	☐ At least half of teacher candidates participate in a research experience that culminates in a presentation, poster, or paper.	☐ At least half of teacher candidates participate in a research experience that culminates in a presentation, poster, or paper and connects research with educational practice.
4B: Pedagogy Courses and Curriculum				
The program ensures that teacher candidates have strong knowledge of physics pedagogy.				
4B-1 **Physics pedagogy[2] credits**	☐	☐ At least half of physics teacher candidates take 1–3 credits of physics pedagogy.	☐ Almost all physics teacher candidates take 3–4 credits of physics pedagogy.	☐ Almost all physics teacher candidates take five or more credits of physics pedagogy.
4B-2 **Scientific practices credits[3]**	☐	☐ Scientific practices account for 1–2 credits within the curriculum.	☐ Scientific practices account for 3–5 credits within the curriculum.	☐ Scientific practices account for six or more credits within the curriculum.
4B-3 **Science pedagogy course instruction**	☐	☐ Most courses teaching science pedagogy are traditionally taught but teach evidence-based methods.	☐ Most courses teaching science pedagogy are evidence-based courses that teach evidence-based methods.	☐ All courses teaching science pedagogy are evidence-based courses that teach evidence-based methods.
4B-4 **Science methods[4] instructor expertise**	☐	☐ Instructor of science methods courses has physics teaching experience.	☐ Instructor of science methods courses has 7th–12th grade physics classroom experience.	☐ Instructor of science methods courses has 7th–12th grade physics classroom experience and more than three years of experience teaching methods.
4B-5 **Disciplinary context of certification coursework**	☐	☐ Some of the required certification coursework is taught in the context of teaching science and/or physics.	☐ Most of the required certification coursework is taught in the context of teaching science and/or physics.	☐ Essentially all of the required certification coursework and field experiences are taught in the context of teaching science and/or physics.
4B-6 **Physics microteaching experiences[5]**	☐	☐ At least half the physics teacher candidates participate in physics microteaching with peers.	☐ Essentially all physics teacher candidates participate in physics microteaching with peers.	☐ Essentially all physics teacher candidates deliver physics microteaching lessons to peers at least twice.
4B-7 **Teaching/Learning Assistant (TA/LA) participation[6]**	☐	☐ There are physics TA/LA opportunities, and some physics teacher candidates participate.	☐ At least half of the physics teacher candidates are physics TAs/LAs at some point.	☐ Essentially all physics teacher candidates are physics TAs/LAs at some point.

Continued

Standard 4 Knowledge and Skills for Teaching Physics

	NP	Possible attributes at Developing Level	Possible attributes at Benchmark Level	Possible attributes at Exemplary Level

4C: Field Experiences in Secondary Physics Teaching

The program provides teacher candidates with high-quality field experiences[7] to put education coursework into practice in a school setting.

	NP	Developing Level	Benchmark Level	Exemplary Level
4C-1 Number of cooperating physics teachers[8] for field experiences[7] PREVALENT	☐	☐ Program has access to a minimally sufficient number of cooperating physics teachers for field placements.	☐ Program has access to a sufficient number of cooperating physics teachers for field placements.	☐ Program has access to more than a sufficient number of cooperating physics teachers for field placements.
4C-2 Quality of field experiences[7] PREVALENT	☐	☐ Candidates have a physics or physical science field experience.	☐ Candidates have a physics or physical science field experience accompanied by a university course.	☐ Candidates have a physics or physical science field experience accompanied by a university course and teach a minimum of five lessons on their own.
4C-3 Experience with different populations and environments PREVALENT	☐	☐ Candidates' field experiences (including student teaching) are with at least two different teachers).	☐ Candidates' field experiences (including student teaching) are with at least two different teachers and two different populations (e.g., cultural backgrounds or socioeconomic status).	☐ Candidates' field experiences (including student teaching) are with at least two different teachers, two different populations, and two widely spaced grade levels.
4C-4 Quality of field experience classrooms PREVALENT	☐	☐ Some field experience learning environments use some evidence-based teaching practices.	☐ Some field experience learning environments primarily use evidence-based teaching practices.	☐ Essentially all field experience learning environments primarily use evidence-based teaching practices.

4D: Student Teaching

The program provides teacher candidates with high-quality student teaching[9] experiences in physics classrooms.

	NP	Developing Level	Benchmark Level	Exemplary Level
4D-1 University supervisor[10] collaboration with PTE team PREVALENT	☐	☐ The university supervisor consults informally with the PTE leadership team to evaluate and support candidates.	☐ The university supervisor officially collaborates with the PTE team to evaluate and support candidates.	☐ The university supervisor is a member of the PTE team.
4D-2 University supervisor[10] experience PREVALENT	☐	☐ The university supervisor has experience teaching physics.	☐ The university supervisor has experience teaching physics and knowledge of evidence-based teaching practices and K–12 teaching environments.	☐ The university supervisor has extensive experience teaching physics, demonstrated experience using evidence-based teaching practices, rich knowledge of K–12 teaching environments, and experience mentoring adults.
4D-3 Quality of cooperating teachers[11] for student teaching	☐	☐ Some cooperating teachers for student teaching have more than three years of physics teaching experience.	☐ Essentially all cooperating teachers for student teaching have more than three years of physics teaching experience.	☐ At least half of cooperating teachers for student teaching are excellent quality (i.e., teach physics, provide quality mentoring, and demonstrate above-average student learning).

Continued

Standard 4 Knowledge and Skills for Teaching Physics

	NP	Possible attributes at Developing Level	Possible attributes at Benchmark Level	Possible attributes at Exemplary Level
4D-4 **Number of quality cooperating teachers[11] for student teaching**	☐	☐ Program has access to a minimally sufficient number of cooperating teachers.	☐ Program has access to a minimally sufficient number of cooperating teachers, most of whom meet the "benchmark" level of quality (4D-3).	☐ Program has access to a sufficient number of cooperating teachers, all of whom meet the "benchmark" level of quality (4D-3).
4D-5 **Quality of student teaching learning environments**	☐	☐ Some student teaching classrooms use some evidence-based teaching practices.	☐ Some student teaching classrooms primarily use evidence-based teaching practices.	☐ Essentially all student teaching classrooms primarily use evidence-based teaching practices.

[1] **Physics degree** is a physics major or minor or its equivalent. Physics minor equivalent is defined at www.phystec.org/webdocs/physicsMinor.cfm. A **physics teacher candidate** is a student who has committed to completing a program of physics teacher education.

[2] **Physics pedagogy credits** are earned through either (1) completing a standalone course devoted to physics teaching and learning, in which case the number of physics pedagogy credits is the same as the number of course credits, or (2) completing a course that has a component about physics teaching and learning (such as a science methods course; a guided inquiry physics course, like Physics by Inquiry; an outreach course; or an experiential learning opportunity for teacher candidates, such as a Teaching/Learning Assistantship), in which case the number of physics pedagogy credits is determined by the fraction of time spent on physics pedagogy. For example, if one-third of the course is physics and it is a three-credit course, then physics pedagogy accounts for one credit.

[3] **Scientific practices** are an element of the Next Generation Science Standards (NGSS) and include, but are not limited to, asking questions and defining problems; analyzing and interpreting data; and engaging in argument from evidence. See ngss.nsta.org/PracticesFull.aspx for the full list.

[4] A **science methods course** is a standalone course exploring techniques in science instruction, taught in the School of Education.

[5] **Microteaching experiences** are short lessons (20 minutes or less) delivered to peers, usually followed by reflection and feedback from peers (see E. Etkina, Phys. Rev. Spec. Top: Phys. Ed. Rsrch., 7, 020110, 2010).

[6] **Teaching/Learning Assistantships** (TA/LA) are positions in physics (or physics-aligned) departments in which undergraduates are trained to work with faculty as instructional assistants to make courses more interactive or to support interactive engagement in already reformed courses.

[7] A **field experience** is an in-classroom K–12 teaching experience for teacher candidates, preferably in a physics or physical-science classroom with an on-campus course component. The goal of a field experience is to put education coursework into practice in a school setting by teaching (or helping to teach) a pre-college class. Observation of K–12 classrooms should not be counted toward this item. College-level teaching experiences (including most LA programs) and student teaching should also not be counted toward this item, as they appear in Standard 3 (Recruitment).

[8] A **cooperating teacher for field experiences** is a certified teacher (preferably a physics teacher) who hosts and supervises students during field experiences.

[9] **Student teaching** is a capstone field experience in which a teacher candidate teaches in a K–12 setting with full control of multiple classes for at least a semester, fulfilling licensure requirements. The student teaching experience is jointly supervised by the "cooperating teacher" at the K12 school and the "university supervisor" at the university.

[10] A **university supervisor** is a member of the university faculty with expertise in teacher education who is the instructor of record for the student teaching experience, which includes observing and supporting teacher candidates during student teaching. Observation includes observing a full lesson and must include written feedback.

[11] A **cooperating teacher for student teaching** is a certified teacher who hosts and supervises student teaching experiences at a school. Because they provide significant mentorship, cooperating teachers should share the PTE team's vision of teaching and learning and have demonstrated mentorship skills (e.g., observing, providing feedback, holding professional conversations, working collaboratively) or receive mentorship training, and they should demonstrate above-average student learning. A "master teacher" designation does not suffice.

Standard 5 Mentoring and Professional Support

The program provides mentoring and induction to support progress towards degree, certification, and retention in the profession.

	NP	Possible attributes at Developing Level	Possible attributes at Benchmark Level	Possible attributes at Exemplary Level

5A: Mentoring and Support Toward a Physics Degree

The physics program provides structures to help teacher candidates persist and thrive in their progress toward a physics degree.

5A-1 **Student community in physics** PREVALENT	☐	☐ There are one or two community-building activities each year (e.g., welcome picnics).	☐ There is an active Society of Physics Students (SPS) chapter or a student lounge.	☐ There is an active SPS chapter and a student lounge.
5A-2 **Student advising and career mentoring[1] in physics**	☐	☐ Advising provides students with consistent and accurate information about degree options.	☐ Advising provides a clear roadmap of courses to accomplish different career goals, and majors are consistently mentored regarding career options.	☐ Advising supports students in tailoring academic programs to their career interests, and majors are consistently mentored regarding career options.

5B: Mentoring and Support Toward Becoming a Physics Teacher

The program helps teacher candidates persist and thrive in their progress toward becoming physics teachers.

5B-1 **Advising[2] of physics teacher candidates** PREVALENT	☐	☐ Teacher candidates receive academic advising from an advisor knowledgeable about PTE.	☐ Teacher candidates receive academic advising from an advisor who provides a clear roadmap of courses to complete physics and PTE requirements as efficiently as possible.	☐ Teacher candidates receive academic advising from an advisor who is able to navigate the PTE requirements, who is knowledgeable about scholarships and external opportunities, and who can provide creative solutions for completion of requirements.
5B-2 **Mentoring of physics teacher candidates by a PTE mentor[3]** PREVALENT	☐	☐ Teacher candidates receive some mentoring from a PTE mentor.	☐ Teacher candidates receive regular mentoring from a PTE mentor with experience in K–12 environments.	☐ Teacher candidates receive regular, sustained, holistic mentoring (including career progress and skills development) from a PTE mentor with experience in K–12 environments.
5B-3 **Community of physics/STEM teacher candidates[4]**	☐	☐ Physics/STEM teacher candidates do one of these: - collaborate in classes; - attend community-building events; - have a lounge or shared workspace.	☐ Physics/STEM teacher candidates do two of these: - collaborate in classes; - attend community-building events; - have a lounge or shared workspace.	☐ Physics/STEM teacher candidates collaborate in classes, attend community-building events, and have a lounge or shared workspace.
5B-4 **Community with in-service teachers**	☐	☐ Some teacher candidates attend campus events with working teachers.	☐ Most teacher candidates attend campus events with working teachers, but such events are occasional.	☐ Many teacher candidates attend campus events with working teachers, and these events are frequent (several times per year).

Continued

Standard 5 Mentoring and Professional Support

	NP	Possible attributes at Developing Level	Possible attributes at Benchmark Level	Possible attributes at Exemplary Level

5C: In-service Mentoring and Professional Community

The program monitors and supports teacher graduates to retain them in the profession and develop their physics teaching expertise.

5C-1 **Alumni community**	☐	☐ The program offers occasional alumni events.	☐ There are meetings of program alumni every year.	☐ There are meetings of program alumni every semester and/or an active online network.
5C-2 **PTE mentor[3] for beginning teachers**	☐	☐ Many alumni receive some mentoring from a PTE mentor.	☐ Many alumni receive regular mentoring from a PTE mentor with experience in K–12 environments.	☐ Many alumni receive regular, sustained, holistic mentoring (including career progress and skills development) from a PTE mentor with experience in K–12 environments.
5C-3 **Professional development for in-service teachers**	☐	☐ Less than 25 hours of professional development are offered per year.	☐ 25–80 hours of professional development are offered per year.	☐ 80+ hours of professional development are offered per year.

[1] **Advising** refers to helping students select course sequences and navigate the path towards their degree. **Mentoring** includes physics skill development and support for career progress. **Tailoring academic programs to career interests** includes taking advantage of program flexibilities, removing barriers, and advising about scholarships and external opportunities, including internships and research experiences.

[2] **Advising** refers to helping students select course sequences and navigate the path towards licensure.

[3] **Mentoring** includes physics teacher skill development and support for career progress (distinct from "advising"). A **PTE mentor** is a faculty member who specializes in physics teacher education, a TIR, or a local teacher who is able to provide mentoring in careers, skills, and teaching development (not just academic advising).

[4] **Community of physics/STEM teachers**. In those institutions with insufficient numbers to create a community among physics teacher candidates, a community of STEM teacher candidates should be considered for this item.

Standard 6 Program Assessment

The program assesses multiple outcomes, using them for program improvement and to advocate for funding and resources.

	NP	Possible attributes at Developing Level	Possible attributes at Benchmark Level	Possible attributes at Exemplary Level
6A: Program Outcomes				
The program is successful at recruiting, graduating, placing, and retaining teacher candidates.				
6A-1 **Annual graduation from PTE program** PREVALENT	☐	☐ On average, there is at least one graduate from the PTE program per year.	☐ On average, there are 2–3 graduates from the PTE program per year.	☐ On average, there are four or more graduates from the PTE program per year.
6A-2 **Annual recruitment in PTE program** PREVALENT	☐	☐ 1–2 students enter the PTE program per year.	☐ 3–5 students enter the PTE program per year.	☐ Six or more students enter the PTE program per year.
6A-3 **Diversity of physics teacher candidates**	☐	☐ There is some racial/ethnic diversity among physics teacher candidates.	☐ The racial/ethnic diversity of physics teacher candidates matches the national average among physics B.S. degree recipients.	☐ The racial/ethnic diversity of physics teacher candidates exceeds the national average among physics B.S. degree recipients.
6A-4 **Career persistence**[1]	☐	☐ At least 70% of PTE program graduates remain in the profession after five years.	☐ At least 75% of PTE program graduates remain in the profession after five years.	☐ At least 80% of PTE program graduates remain in the profession after five years.
6B: Program Evaluation and Improvement				
The program systematically collects and analyzes student- and program-level data to make informed decisions about program development and improvement.				
6B-1 **Tracking program metrics**[2] PREVALENT	☐	☐ The program systematically tracks graduation rates.	☐ The program systematically tracks graduation and recruitment rates.	☐ The program systematically tracks graduation, recruitment, and persistence rates.
6B-2 **Assessing learning outcomes**[3]	☐	☐ The program assesses at least two candidate learning outcomes.	☐ The program assesses at least three candidate learning outcomes.	☐ The program assesses at least three candidate learning outcomes plus K–12 student outcomes in classrooms of program alumni.
6B-3 **Feedback**[4] **from stakeholders**	☐	☐ Program feedback is collected from most candidates or alumni.	☐ Program feedback is collected from most candidates and alumni.	☐ Program feedback is collected from most teacher candidates, alumni, and at least some employers.
6B-4 **Program improvement from feedback and program data**[5]	☐	☐ The program uses feedback and program data to make occasional improvements.	☐ The program has carefully examined feedback and program data to make substantial improvements at least occasionally.	☐ The program conducts an annual evaluation or otherwise engages in a systematic cycle of continuous improvement.

Continued

	NP	Possible attributes at Developing Level	Possible attributes at Benchmark Level	Possible attributes at Exemplary Level

6C: Communication to Stakeholders

The program communicates its successes to key stakeholders to build support for the program.

6C-1 **Communication within the university** PREVALENT	☐	☐ The program consistently communicates its assessment data within the program team.	☐ The program consistently communicates about its successes with one or two departments or academic units.	☐ The program consistently communicates about its successes in campus-wide publications or venues.
6C-2 **Communication with university administrators**	☐	☐ Program leaders consistently communicate with department chairs about program successes.	☐ Program leaders consistently communicate with higher administrators about program successes.	☐ Assessment data is strategically used to argue for program stability by addressing administrators' highest priorities (e.g., student recruitment, financial return).
6C-3 **Publicity and advocacy**[6]	☐	☐ Program successes are publicized at the city or county level (e.g., newspaper articles).	☐ Program successes are publicized (at least at the city level) and include data-based evidence of success, OR program leaders engage in state advocacy.	☐ Program successes are publicized based on data, AND the program leaders engage in state advocacy.
6C-4 **Scholarly work**	☐	☐ The program has contributed to scholarly work in teacher education conducted by other researchers.	☐ The program leaders have published a scholarly paper on the program or its outcomes.	☐ The program conducts systematic research investigations to contribute to knowledge in physics teacher education.

[1] **Career persistence** is among the PTE program graduates who become teachers.

[2] **Tracking program metrics**. If the academic unit housing the program (such as the School of Education) tracks these numbers, this can be considered as program tracking.

[3] **Learning outcomes** for teacher candidates include grades, DFW rates, learning gains from concept inventories, Praxis II scores, and measures of pedagogical skills (e.g., Reformed Teaching Observation Protocol, UTeach Observation Protocol).

[4] **Feedback** may be collected through exit interviews, surveys, and so on.

[5] **Program data** include program metrics, learning outcomes, Physics Teacher Education Program Analysis (PTEPA) Rubric scores, or other evaluative measures.

[6] **Advocacy** includes advocating for changes to state policy that could benefit physics teachers (e.g., serving on a state committee or issuing a policy brief).