PTEPA Rubric

A rubric to describe and guide physics teacher education programs

PTEPA Rubric and resources at phystec.org/thriving.
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About the PTEPA Rubric 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.

The PTEPA Rubric focuses on the role of the physics disciplinary department and faculty in providing recruitment and high-quality preparation for future *physics* teachers. It is not intended to fully characterize a teacher preparation program and thus does not emphasize areas that lie exclusively within the domain of a school of education; for those wishing to assess the overall quality of a program, we recommend the Teacher Education Program Assessment (TEPA) by C. Coble.

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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 The faculty members or administrators 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.

PTE mentor A university employee who mentors and coaches teacher candidates in careers, skills, and teaching development (not just academic advising). The PTE mentor may be, for example, a faculty member who specializes in physics teacher education or a physics TIR.

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.

Licensure pathway This includes course requirements for licensure and content of licensure courses. Desirable modifications include, for example, adding physics content to licensure courses, satisfying multiple requirements with a single activity, and reducing (or not increasing) time to certification.

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

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 UTeach "Step 1" or other entry-level courses, among other possibilities.

Teaching/Learning Assistantships (TA/LA) 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.

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).

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, which occurs *prior* to student teaching.

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.

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

Not Present (NP) Item is not present in the program.
Developing The program performs better than a typical U.S. institution of higher education on that item.
Benchmark The program performs at a recommended level on that item.
Exemplary The program is among the best-performing on that 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.

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 and consistently that teacher preparation is part of the core institutional mission, and strategic priorities are explicitly well aligned with teacher preparation.
1A-3 Administrative 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 evidence of SoE support for *science* teacher education.	☐ Additionally, there is 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.

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	■	☐ The program leader(s)' PTE activities are officially included as part of service.	☐ PTE program leader(s) are granted modest time to engage in PTE activities.[6]	☐ PTE program leader(s) are granted significant time to engage in PTE activities.[6]
1B-3 Recognition for PTE program team[7]	■	☐ Members of the PTE program team have received modest recognition[8] for engaging in PTE (in the past three years).	☐ Members of the PTE program team have received concrete recognition[9] for engaging in PTE (in the past three years).	☐ The PTE team is celebrated by the college and/or institution through significant public recognition (in the past 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 have 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 one 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 recognition** could include a thank-you letter, a notice in the departmental newsletter, verbal recognition for PTE activities, or broad recognition for educational activities but not specific recognition for PTE.

[9] **Concrete recognition** could include award nominations for PTE, frequent written or verbal recognition at the department or college level, financial rewards, and so on.

[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 that 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 Assistant 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 enable effective leadership.

	NP	Possible attributes at Developing Level	Possible attributes at Benchmark Level	Possible attributes at 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	Possible attributes at Developing Level	Possible attributes at Benchmark Level	Possible attributes at 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	■	☐ At least one member of the team is tenure-track (or other relevant leadership designation).	☐ At least one member of the team is tenured.	☐ At least one member holds positional power in the department (e.g., chair, undergraduate chair).
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 strongly 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 Connections to K–12 teachers PREVALENT	■	☐ At least one member of the team has current informal connections to local physics teachers.	☐ At least one member of the team is regularly engaged with local physics teachers.	☐ At least one member of the team is engaged with a significant fraction of local physics teachers or holds a current leadership position in local schools.
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 conference.
2B-9 Reputation of PTE program team for leading change	■	☐ 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 and mutual awareness between units on PTE program elements.	☐ There are semi-regular meetings or presentations between units on PTE program elements.	☐ There are regular meetings between units to address any issues related to PTE program elements, including program accreditation.
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 Collaboration with PTE mentor[8] on student teacher placement PREVALENT	■	☐ 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-5 University supervisor[9] 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.
2C-6 Departmental representation	■	☐ The PTE team includes faculty in physics or education who can name informal contacts in the other department.	☐ The PTE team includes faculty in both the physics and education departments.	☐ PTE *program leaders* include faculty in both the 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-7 **Collaboration on licensure pathway for physics students**[10]	■	☐ Collaboration between units has identified opportunities for improving the licensure pathway.	☐ Collaboration between units has improved the licensure pathway.	☐ Collaboration between units has led to mutual agreement on the needs of physics teacher candidates and has produced a cohesive and streamlined licensure pathway.
2C-8 **Collaboration on advising for physics teacher candidates**	■	☐ There are informal connections between faculty in physics and education to address advising questions for physics teacher candidates.	☐ There are regular cross-department meetings to discuss progress of physics teacher candidates.	☐ There are formal cross-departmental structures to provide discipline-specific advising to physics teacher candidates.

[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.

[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 university employee who mentors and coaches teacher candidates in careers, skills, and teaching development (not just academic advising). The PTE mentor may be, for example, a faculty member who specializes in physics teacher education or a physics TIR.

[9] 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.

[10] The **licensure pathway** includes course requirements for licensure and content of licensure courses. Desirable modifications include, for example, adding physics content to licensure courses, satisfying multiple requirements with a single activity, and reducing (or not increasing) time to certification.

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 and mechanisms to attract them to the profession.				
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 **Physics teaching advisor** PREVALENT	☐	☐ One person in physics can direct students to a viable path to becoming a physics teacher.	☐ One person in physics can provide detailed advising regarding the options for becoming a physics teacher.	☐ One person in physics can provided detailed advising regarding becoming a physics teacher and serves as the PTE mentor for teacher candidates.
3A-4 **Recruitment network**	☐	☐ Several physics faculty/staff actively refer students to the PTE program.	☐ Several physics faculty/staff and at least one other entity[3] actively refer students to the PTE program.	☐ Several physics faculty/staff and more than one other entity[3] actively refer students to the PTE program.
3A-5 **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 **Physics teaching ambassador** PREVALENT	☐	☐ Potential PTE candidates are exposed to a positive ambassador for the *science* teaching profession.	☐ 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-2 **Accurate information about career benefits**[4] **of teaching** PREVALENT	☐	☐ Potential PTE candidates reliably get accurate information about financial compensation for teachers in the U.S.	☐ Potential PTE candidates reliably get accurate information about financial compensation for teachers in the U.S., as well as at least two less commonly known advantages of the profession.	☐ Potential PTE candidates reliably get accurate information about financial compensation for *local* teachers, as well as at least two less commonly known advantages of the profession.
3B-3 **Program promotion**[5]	☐	☐ There is minimal program promotion (1–2 practices).	☐ There is modest program promotion (3–4 practices).	☐ There is substantial program promotion (5+ practices).
3B-4 **Physics faculty discuss teaching as a career option**	☐	☐ A few physics faculty discuss teaching as a viable career option (rather than a backup plan).	☐ Many physics faculty discuss teaching as a viable career option.	☐ Most physics faculty discuss teaching as a normative career choice (e.g., on equal weight with academic or industrial careers).
3B-5 **Physics department exposes students to diverse career options**	☐	☐ The physics department offers students some opportunities to learn about diverse careers, including teaching (e.g., career day, alumni talks).	☐ The physics department's mission includes preparing students for diverse careers, offering numerous opportunities for them to learn about such careers (including teaching).	☐ Additionally, the physics department offers a career seminar or other similar sustained career exploration opportunities that discuss teaching careers.

Continued

	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[6] give first- or second-year students a taste of the rewards and challenges of teaching.				
3C-1 Attractiveness of early teaching experiences PREVALENT	☐	☐ Early teaching experiences are *somewhat* attractive to physics students (e.g., low physics content, time-intensive).	☐ 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	☐	☐ 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	☐	☐ Students participating in early teaching experiences are informed at least once about teaching careers and/or the PTE program.	☐ Students participating in early teaching experiences are regularly 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 to consider teaching as a career and assisted in taking the next steps towards certification.
3C-5 Exposure to K–12 teaching environments	☐	☐ Early teaching experiences include *some* exposure to 4th–12th grade environments or students, with a physics or physical science focus.	☐ Early teaching experiences include *substantial* exposure to 4th–12th grade environments or students, with a physics or physical science focus.	☐ Early teaching experiences occur *primarily* in 4th–12th grade environments, with a physics or physical science focus.

[1] **Numbers of physics majors** can be determined using data at https://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] **Other entities** may include other departments, programs, or high school teachers.

[4] **Career benefits** include the following less commonly known advantages: (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, 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 https://www.aps.org/units/fed/newsletters/fall2017/survey.cfm for more information.

[5] **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), and announcements (in campus newsletters, email lists, etc.). Any one of these counts as a practice.

[6] **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 UTeach Step 1 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).

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	NP	Possible attributes at Developing Level	Possible attributes at Benchmark Level	Possible attributes at Exemplary Level
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 **Undergraduate licensure pathway**[7] PREVALENT	☐	☐ The physics program allows some teaching credits to count toward physics degree requirements (e.g., electives or humanities requirements).	☐ There is an undergraduate licensure pathway for physics majors.	☐ The physics program offers a teaching track or concentration that is well designed and streamlined to integrate with certification requirements.
3D-2 **Post-baccalaureate licensure pathway**[7]	☐	☐ There is a post-baccalaureate licensure option.	☐ There is a post-baccalaureate licensure option with expedited options for undergraduate majors.	☐ Additionally, there is a part-time coursework option.
3D-3 **Time to certification**[8] **for physics teacher candidates**[9]	☐	☐ Most physics teacher candidates will require five years (which includes the undergraduate degree) to achieve certification.	☐ Most physics teacher candidates will require four and a half years (which includes the undergraduate degree) to achieve certification.	☐ Most physics teacher candidates can achieve certification within a four-year undergraduate degree.
3D-4 **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.

[7] The **licensure pathway** includes the degree and course requirements for physics teaching licensure. Examples of expedited options for a post-baccalaureate program include waiving some certification requirements, allowing undergraduate experiences (such as Learning Assistant experience) to count towards the entry or certification requirements for the post-baccalaureate program, or allowing students to take courses in the post-baccalaureate program as undergraduates.

[8] **Time to certification** should be calculated using the undergraduate or post-baccalaureate licensure pathway, whichever is present and/or most commonly used. While not required to achieve this item, it is recommended to build the licensure pathway such that students may complete the certification requirements within the allotted time, even if they decide to pursue licensure after their sophomore year.

[9] A **physics teacher candidate** is a student who has committed to completing a program of physics teacher education.

Standard 4 Knowledge and Skills for Teaching Physics

The program ensures that teacher candidates are well prepared to teach physics effectively through rigorous and experiential preparation in physics content and pedagogy.

	NP	Possible attributes at Developing Level	Possible attributes at Benchmark Level	Possible attributes at Exemplary Level
4A: Physics Content Knowledge				
The program ensures that physics teacher candidates have strong physics content knowledge.[1]				
4A-1 **Physics degree for physics[2] teacher candidates[3]** 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 physics 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[4]				
The program ensures that physics teacher candidates have strong knowledge of physics pedagogy.				
4B-1 **Physics pedagogy credits[5]**	■	☐ At least half of physics teacher candidates take 1–3 credits of physics pedagogy.	☐ Almost all physics teacher candidates take 1–3 credits of physics pedagogy.	☐ Almost all physics teacher candidates take four or more credits of physics pedagogy.
4B-2 **Scientific practices credits[6]**	■	☐ 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 **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 is taught in the context of teaching science and/or physics.
4B-4 **Physics microteaching experiences[7]**	■	☐ 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-5 **Teaching/Learning Assistant (TA/LA) participation[8]**	■	☐ 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: Practical K–12 School Experiences

The program provides physics teacher candidates with high-quality, practical teaching experiences in the discipline (i.e. "clinical experiences") to put education coursework into practice in a K–12 school setting. Such practical experiences may include practicum, observation, field experiences,[9] and student teaching.[10]

	NP	Possible attributes at Developing Level	Possible attributes at Benchmark Level	Possible attributes at Exemplary Level
4C-1 Number of cooperating physics teachers[11] PREVALENT	■	☐ Program has access to a minimally sufficient number of cooperating physics teachers for classroom placements.	☐ Program has access to a sufficient number of cooperating physics teachers for classroom placements.	☐ Program has access to more than a sufficient number of cooperating physics teachers for classroom placements.
4C-2 Quality of cooperating physics teachers[11] PREVALENT	■	☐ Some cooperating physics teachers have more than three years of physics teaching experience.	☐ Essentially all cooperating physics teachers have more than three years of physics teaching experience.	☐ Additionally, at least half of cooperating physics teachers are excellent quality (e.g., teach physics and primarily use research-validated teaching practices).
4C-3 Field experiences[9] in physics PREVALENT	■	☐ Candidates engage in structured observation of a K–12 physics or physical science classroom accompanied by reflection and connection to coursework.	☐ Candidates have a K–12 physics or physical science field experience, including teaching at least one lesson and receiving feedback.	☐ Candidates have a *high-quality*[9] K–12 physics or physical science field experience.
4C-4 Quality of university supervisor[12] for student teaching 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 using evidence-based teaching practices and rich knowledge of K–12 teaching environments.

1 **Physics content knowledge** differs depending on how the curriculum is organized (e.g., around concepts, phenomena, or projects). This instrument does not assess the approach to physics teaching that is promoted by a PTE program. It also does not define "physics content," which may be understood to include scientific practices or crosscutting concepts as well as disciplinary core ideas.

2 **Physics degree** is a physics major or minor or its equivalent. "Physics minor equivalent" is defined at http://www.phystec.org/webdocs/physicsMinor.cfm.

3 A **physics teacher candidate** is a student who has committed to completing a program of physics teacher education.

4 Note: The PTEPA Rubric assesses only the physics-specific elements of the curriculum for teacher candidates. It is not intended to fully characterize a teacher preparation program curriculum and training, and thus it does not emphasize areas that lie primarily within the domain of a school of education; for those wishing to assess the overall quality of a program, we recommend the Teacher Education Program Assessment (TEPA) by C. Coble (2014).

5 **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.

6 **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 http://ngss.nsta.org/PracticesFull.aspx for the full list.

7 **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).

8 **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.

9 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, that occurs *prior* to student teaching. The goal of a field experience is to put education coursework into practice in a school setting by observing or teaching a pre-college class. College-level teaching experiences (including most LA programs) and student teaching should not be counted toward this item, as they appear elsewhere. A *high-quality* field experience is one that is accompanied by a university course, where students teach at least five lessons on their own along with structured feedback, and in which the learning environment uses research-validated practices that reflect the practices described in certification coursework.

10 **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 K–12 school and the "university supervisor" at the university.

11 A **cooperating teacher** is a certified teacher (preferably a physics teacher) who hosts and supervises students during field experiences and/or student teaching. If the quality of cooperating teachers for field experiences is quite different from those for student teaching, emphasize the quality of the cooperating teachers for the student teaching experience.

12 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.

Standard 5 Mentoring, Community, and Professional Support

The program provides mentoring and induction to support progress toward degree, certification, and retention in the profession, supported by strong student community.

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

5A: Mentoring and Community Support Toward a Physics Degree

The physics program structures and its student community 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 Community Support Toward Becoming a Physics Teacher

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

5B-1 **Academic advising[1] of physics teacher candidates** PREVALENT	☐	☐ Teacher candidates receive academic advising from one or more advisors (e.g., in physics and/or education) knowledgeable about PTE.	☐ Teacher candidates receive academic advising from a single advisor who provides a clear roadmap of courses to complete physics and PTE requirements as efficiently as possible.	☐ Teacher candidates receive academic advising from a single 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 **PTE mentor[2] for physics teacher candidates** PREVALENT	☐	☐ Teacher candidates have access to a PTE mentor.	☐ Teacher candidates are paired with a dedicated PTE mentor.	☐ Additionally, PTE mentors have a close relationship with each mentee because they interact with mentees in multiple contexts over the course of their undergraduate careers.
5B-3 **Coordinated mentoring**	☐	☐ There is some coordination among the PTE mentor, university supervisor, cooperating teacher(s), and academic advisor.	☐ There is moderate coordination among the PTE mentor, university supervisor, cooperating teacher(s), and academic advisor.	☐ There is substantial coordination among the PTE mentor, university supervisor, cooperating teacher(s), and academic advisor, which may include written expectations and frequent communication about candidate progress and skill development.
5B-4 **Community of physics/STEM teacher candidates[3]**	☐	☐ 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-5 **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, Community, 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, giving them access to a professional community that helps to retain them in the profession and to 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 **Local physics teachers group**	■	☐ There is a local/regional physics teachers group (e.g., AAPT affiliate group).	☐ There is a local/regional physics teachers group that meets at least two times/year.	☐ There is a local/regional physics teachers group that meets at least two times/year and has significant interaction with the PTE program.
5C-3 **PTE mentor[2] 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-4 **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 or licensure. **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] A **PTE mentor** is a university employee who mentors and coaches teacher candidates in careers, skills, and teaching development (not just academic advising). The PTE mentor may be, for example, a faculty member who specializes in physics teacher education or a physics TIR.

[3] **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 2–4 graduates from the PTE program per year.	☐ On average, there are five 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**	■	☐ Under-represented racial/ethnic groups comprise at least 5% of physics teacher candidates.	☐ Under-represented racial/ethnic groups comprise at least 10% of physics teacher candidates.	☐ Under-represented racial/ethnic groups comprise significantly more than 10% of physics teacher candidates.
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 the number of program completers.	☐ The program systematically tracks the numbers of teacher candidates and program completers.	☐ Additionally, the program systematically tracks data on either candidate diversity or career persistence.
6B-2 **Feedback**[3] **from stakeholders** PREVALENT	■	☐ Program feedback is collected from most candidates or alumni.	☐ Program feedback is collected from most candidates *and* alumni or employers.	☐ Program feedback is collected from most candidates and alumni and at least some employers.
6B-3 **Assessing learning outcomes**[4] **for physics teacher candidates**	■	☐ The program assesses at least two candidate learning outcomes.	☐ The program assesses at least three candidate learning outcomes.	☐ The program assesses at least four candidate learning outcomes.
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** PREVALENT	☒	☐ 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 within the institution.	☐ Program successes are publicized at the city or county level (e.g., newspaper articles), *or* program leaders engage in state advocacy.	☐ Program successes are publicized at the city, county, or state level, AND the program leaders engage in state advocacy.
6C-4 **Scholarly work**	☒	☐ Members of the program team have contributed to scholarly work in teacher education conducted by researchers outside the program.	☐ Members of the program team conduct systematic research to contribute to knowledge in physics teacher education.	☐ Members of the program team have published a scholarly paper on the program or its outcomes.

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

[4] **Learning outcomes** for teacher candidates include grades, DFW rates, learning gains from concept inventories, Praxis II scores, measures of pedagogical skills (e.g., Reformed Teaching Observation Protocol, UTeach Observation Protocol), and K–12 student outcomes in classrooms of program alumni.

[5] **Program data** include program metrics, learning outcomes, Physics Teacher Education Program Analysis (PTEPA) Rubric ratings, 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).