Information on the Development, Validation, Administration and Use

of the

PACE Student Interest in Computer Science Survey

Background on the Survey

Student interest and motivation to learn computer science (CS) plays a critical role in broadening academic engagement in the discipline. Various stakeholders and experts say that an early interest in CS is a key factor in increasing participation in CS related fields of work (Ottenbreit-Leftwich et. al., 2021). Grover, Pea, and Cooper (2014) state that middle school is shown to be a key time for identity building in students, and that by high school, gender differences are established (Denner, 2011). Understanding what drives middle grade students to learn about and engage with CS topics is pivotal to furthering broad participation in the field. While middle grades have been an area of focus for this reason, there is still more room for research to drive the actual development of interventions, especially those that study predictive factors for interest in CS in school and beyond (Denner, 2011). There is a need for assessment instruments to ascertain student views on the changing landscape of computer science education (Weibe et al., 2020).

The *PACE Student Interest in Computer Science Survey* is an assessment of middle grade student motivation to learn about and interest in the field of computer science (CS) that was created, in part, to address this need. The survey includes items that examine student beliefs on agency and self-efficacy in their CS courses, attitudes about the importance of CS for their academic and career aspirations, and participation in a variety of CS-related activities in- and out- of school time. To facilitate analysis by student characteristics, the survey also includes items on student characteristics, such as the current grade and gender of the student and whether or not the student is currently enrolled in a CS course.

The survey was originally designed in response to requests from instructional staff in districts involved in PACE. In one district, for example, an administrator sought data that could be provided to the school board to approve the hiring of an additional CS teacher. In another district, a teacher was interested in knowing the previous CS experiences of her students to help her plan instruction for the upcoming semester.

The survey was first administered in PACE districts in 2022 and made available for PACE districts in each subsequent fall and spring. Slight modifications were made to the survey in 2023. As of spring 2025, more than 2,500 student responses had been received from the six PACE districts.

Development and Validation

The development of the initial version of the survey occurred in 2022. The PACE team conducted a review of existing surveys on computer science engagement. Some items on the PACE survey were adopted from the previously published *Assessing Student Interest in Computer Science* survey (LeadCS.org, 2015).

The survey went through several rounds of review for content validation. This included internal review by technical assistance liaisons on the PACE team who had expertise in computer science education, and a subsequent round of review by Digital Literacy and Computer Science Content Specialists at the Massachusetts Department of Elementary and Secondary Education. These rounds of review led to changes in the response options for several items, the addition of items for student characteristics, and refinements in the language in several sections.

After multiple rounds of administration to students, both Factor Analyses and Cronbach's alpha were used to determine the internal consistency and reliability of the instrument. The Cronbach's alpha values for individual items range from about 0.74 to 0.79, while the overall test scale's reliability is 0.8091, which is considered good. This suggests that the items consistently measure the same concept.

The factor analysis assessed the internal consistency of questions related to computer science (CS) across three categories using Cronbach's alpha:

- Interest in CS: Five questions about the usefulness and importance of CS skills for education and future employment had a Cronbach's alpha of 0.81, indicating good consistency among responses.
- Attitude towards CS: Seven items assessing confidence, interest, and intentions regarding CS classes and careers had an alpha of 0.87, showing very good internal consistency.
- Activities in CS: Fourteen activities related to coding, gaming, robotics, and other CS-related tasks had an alpha of 0.91, indicating excellent consistency within this set of questions.

Overall, these alpha values suggest that the questions within each category reliably measure the same underlying concept of interest, attitude, and activity in CS.

Guidance on Administration and Use

Based on feedback received by PACE district liaisons from participating districts, the *PACE Student Interest in Computer Science Survey* has been successfully used for multiple purposes in the project. Examples of use:

- Classroom teachers have used the survey as an initial activity to gather information on student interests in CS, the frequency of their engagement in CS, and the level of their previous experience with CS. The results inform lesson planning and help teachers adjust instruction to fit their students' backgrounds.

- School and district administrators used the survey to gather information on student interest in CS to inform, with other indicators, decisions about course offerings, purchases of materials, and staffing.

In addition, we believe that, with evidence of the validity of the survey, it could be used in the future by:

- Education researchers and district staff as an outcome measure of student perspectives, to examine the influences of CS-related initiatives and programming.
- By classroom teachers and departments as a formative assessment, administered prior-to and after- CS units. For units in which a learning goal is student understanding of the field of CS and its value, the surveys can serve as an easily administered assessment and provide teachers will data on possible shifts in student understanding.

Administering the survey

A key factor in gathering meaningful, valid data is the use of an administration process that aligns with the intended use of the findings and which limits bias in who can take or complete the survey. For example, a teacher interested in gathering information from students to inform instruction should take steps to ensure that all students in the class are able to complete the survey in time for their results to be included in instructional decisions.

The survey is designed to be administered online. The PACE project used the Qualtrics platform, which allowed responses to be handled securely. Teachers and administers may be more familiar with other online survey platforms, such as GoogleForms or SurveyMonkey. The design and structure of the survey should allow it to be easily entered into any platform (e.g., there is no "skip-logic" that needs to be created or pre-populated fields).

The survey consistently required 5-10 minutes to be completed by middle grade students. When administered at the school-level, this time was typically provided during a homeroom or advisory period to ensure that all students had access to the survey at the same time.

References

Denner, J. (2011). *What predicts Middle School Girls' interest in Computing?* International Journal of Gender, Science and Technology. https://genderandset.open.ac.uk/index.php/genderandset/article/view/106

Grover, S., Pea, R., & Cooper, S. (2014). Remedying misperceptions of computer science among middle school students. *Proceedings of the 45th ACM Technical Symposium on Computer Science Education*, 343–348. https://doi.org/10.1145/2538862.2538934

LeadCS.org (2015). Assessing Student Interest in Computer Science. CEMSE, Outlier Research & Evaluation, University of Chicago. http://www.leadCS.org

Ottenbreit-Leftwich, A. T., Kwon, K., Brush, T. A., Karlin, M., Jeon, M., Jantaraweragul, K., Guo, M., Nadir, H., Gok, F., & Bhattacharya, P. (2021). The impact of an issue-centered problem-based learning curriculum on 6th grade girls' understanding of and interest in Computer Science. *Computers and Education Open*, *2*, 100057. https://doi.org/10.1016/j.caeo.2021.100057

Wiebe, E., Rachmatullah, A., Akram, B., Boulden, D., Mott, B., Boyer, K., & Lester, J. (2020). Development and validation of the Middle Grades Computer Science Concept Inventory (MG-CSCI) assessment. *EURASIA Journal of Mathematics, Science and Technology Education*, *16*(5). https://doi.org/10.29333/ejmste/116600