Pathway2Careers (P2C) Math Curriculum Evaluation Summary

Based on the 71-pg evaluation prepared by the University of Louisville's *Center for Research in Mathematics and Science Teacher Development* (*CRIMSTED*)

March 2022 - Evaluation Date, *CRIMSTED*

April 2022 - Evaluation Summary Date, NS4ed, LLC

About Us: NS4ed and Pathway2Careers (P2C)

NS4ed™ is an educational research and development company dedicated to negotiating services for education. NS4ed provides effective, vested, engaging sole source solutions in:

customized labor market data,
career exploration tools,
and mathematics & career-connected learning curricula.

NS4ed invests in quality measures to ensure that our innovative solutions are high-quality and provide exceptional student experience, comprehensive learning, and support best practices in teaching. We participate in research, user surveys, thorough professional reviews, and in-depth evaluations of our curricula and platform. The valuable feedback we receive from our evaluators, educator-partners, teachers, and students influences our solutions – making them better as we incorporate evaluators' findings and our clients' needs and wants.

As the first-of-its-kind comprehensive mathematics curricula with a career-centered learning lens, **Pathway2Careers™ (P2C) Math Curricula** allows students to interact with more than 650 unique occupations and receive in-depth exploration of standard math concepts. Following the guidance of the company founder and NS4ed Chief Executive Officer, Dr. Joseph L. Goins, P2C aligns with career-connected learning principles and engages learners "differently about mathematics." P2C curricula focus on the intersection of the workplace and education, which incorporates and introduces students to regional labor market data and infuses career-connected learning into math.

"Career connected learning," introduced by the National Center for College & Career Transitions, exposes students to the world of work during the learning process (Meeder & Pawlowski, 2020). P2C serves as a bridge bringing together career-connected learning strategies and academic content. P2C teaches essential transferable work skills like teamwork, critical thinking, problem-solving, and creativity, and it engages students in mathematical reasoning using examples from specific industries and career clusters.

P2C curricula allow students to see better how mathematical concepts are meaningful and relevant, supporting learners and helping them find purpose in learning. Pathway2Careers helps *all* students to attain a successful future through career exploration and mathematics. Ultimately, career-connected learning helps students understand the "why" behind the "what." As cited in several studies, when students are provided with tools to make learning relevant and applicable to themselves, their motivation, performance, retention, and interest increase (Malka & Covington, 2005; Jang, 2008; González et al., 2009; Marzano & Pickering, 2011; Yeager & Dweck, 2012; Hulleman et al., 2014).

CRIMSTED P2C Math Curriculum Evaluation Executive Summary

The University of Louisville *Center for Research in Mathematics and Science Teacher Development* (*CRIMSTED*) is within the College of Education and Human Development and is well-known for teacher preparation and creating nationally recognized and competitive mathematics and science education doctoral programs. *CRIMSTED* promotes interdisciplinary work and collaboration between University of Louisville Engineering and Arts and Sciences faculty and educators in local school districts.

CRIMSTED's unique evaluation looks at NS4ed's work from a methodology and detailed metrics based on the effectiveness of teaching and learning; it focuses on teaching approaches and asks how the teacher will use and implement the solutions assuming that the P2C math course is their primary curriculum. They conducted a thorough independent evaluation of NS4ed's P2C five mathematics courses (middle-high school), including Pre-Algebra (8th grade), Algebra I, Geometry, Algebra IIa, and Algebra IIb. Each course is available in digital format or PDF version. This evaluation focused on the student-view PDF and the teacher-view PDF version of lessons and materials. Both versions are mainly similar.

A team of three scholars conducted the *CRIMSTED* evaluation process, and it used a three-fold approach, conducting random sampling –drawing from 150 lessons for each of the five courses. The 71-page evaluation prepared by *CRIMSTED* for NS4ed meticulously analyzes course lesson content and examines the courses holistically. *CRIMSTED* reported that complete math standards are addressed across all P2C courses and recognized four notable curriculum strengths: breadth of career integration; rich array of career connections of high interest; incorporation of comprehensive mathematical ideas; and systemic integration of mathematical representations for engaging students. (2022, *CRIMSTED*, pgs.5-6; 29; 43-49).

Each evaluated P2C math course consists of 150 total lessons (comprehensive for a school year), of which approximately 50 are "application lessons" and 100 are "exploration lessons." As identified by *CRIMSTED*, the *application lessons* "are designed to foreground career applications and context as the starting point for the lesson, and the lesson addresses the targeted mathematics within that context," also defining the *exploration lessons* as those that "apply an instructional lens of conveying key ideas, procedures, terminology, etc., which are the foundations on which the applications are based." Lessons also include "unique curricular features…centered around contextualizing mathematic concepts within various careers" (*CRIMSTED*, 2022, p. 8). The team also examined the curricula holistically.

Evaluation Process

The *CRIMSTED* evaluation incorporated a three-fold approach:

- Conducting multi-level stratified random sampling of lessons;
- Sampling proportion of lessons with a 95% confidence true evaluation metric;
- Practicing interrater reliability (2022, pgs.8-9).

Three Categories of Evaluation Components & Metrics

Application Lessons

Career Video Relevance & Interest

Consistently scored high in all five courses.

Career Awareness

Consistently scored high in all five courses.

Cognitive Rigor – Depth of Knowledge (DOK)

Consistently scored medium in all five courses.

Comprehensiveness

Consistently scored high in all five courses.

Quality of Lessons

Consistently scored medium in four courses and medium approaching high in Geometry.

Exploration Lessons

Career-Contextualized Tasks

Each course contextualized ~4 tasks/average lesson in a career context.

Incorporation of Career Suggestions

Consistently provided at least two suggestions per lesson connecting math concepts to career.

Comprehensiveness

Consistently scored high in all five courses.

Quality of Lessons

Consistently scored medium in four courses and approached high in Pre-Algebra.

Holistic Course Evaluations

Standards Alignment

Consistently scored high in all five courses.

Structure, Flow, & Quality

Consistently scored high in all five courses.

Quality of Pedagogical Support

Consistently scored low to medium in all five courses.*

Breadth of Career Integration

Wide variety of career clusters and career representation across all five courses. **"One unique and high-profile feature of this curriculum across all of the courses is the very systematic and thorough integration of careers into the mathematics"** (2022, *CRIMSTED*, p.47).



Notable Curriculum Strengths

***CRIMSTED* Recognized 4 Content Areas as Unique with "Notable Curriculum Strengths"**

I. Career Integration

"Unique and high-profile integration of career-contextualized applications for problem solving...These career-oriented applications are systemically integrated and can help effectively answer that perennial student question, "**When will we ever use this stuff?"** (2022, *CRIMSTED*, p.5).

"Overall, an effective use of a wide variety of applications in an array of contexts, many of which may be of particular interest to students (e.g. how computer animators use triangular meshes to generate 3-D objects and make them 'move' in an animated movie). **All core geometric concepts across the entire course have multiple applications presented, ensuring that students who experience this course will complete the course having considered many ways the geometry can be applied"** (p34).

The P2C Math Curriculum **"breadth of career integration…provides a clear strength of the curriculum for potentially enhancing the student-perceived relevance of mathematics to their own lives, and thus has the potential to strengthen student interest – and hence attainment – in mathematics"** (p.47).

II. Rich Array of Career Connections of High Interest

"Thorough integration of a **rich array of career connections** is likely to be of **high interest and relevance for students** across a broad spectrum…." (p.5).

"Collectively across the entire course [Pre-Alg], there is a **wide variety of contexts and applications for situating the mathematics**, and **students are likely to strengthen their abilities to see and recognize mathematics in many facets of everyday life"** (p.35).

"This broad spectrum of career domains offers a strong possibility that all students will find something of personal interest to them" (p. 49).

III. Comprehensive Mathematical Ideas

"Lessons typically include **multiple representations such as graphs, tables, verbal descriptions, and equations/functions**…"(p.43).

"Comprehensively addresses the range of mathematical ideas called for in State Standards – Mathematics. This curriculum serves as a complete set of materials, summaries, syntheses, and guides that would serve students and teachers well as reference material even after completion of a particular course...these materials are also w**ell-crafted to serve as reference material** for such goals as **ACT or SAT preparation**; **state standardized test preparation**; or for reviewing..." (p.5).

"The curriculum resources [Alg I] for teaching functions and rate of change are **strong**" (p.33).

IV. Engaging Systemic Integration of Mathematical Representations

"Systemic integration of multiple mathematical representations (e.g., equations, graphs, images, drawings, words, tables, coordinate systems) and effective guidance and **effective guidance for students on how to navigate**...The rich and systematic integration of these multiple mathematical representations are likely to be helpful for students to cognitively strengthen their understanding of connections among mathematical ideas and between **mathematics and other domains such as science, art, communication, etc."** (p.6).

"Many of the **graphics are high-quality and helpful pedagogically**" [Geometry](p. 32).

"Some lessons **incorporate cognitively richer tasks**, such as asking students to predict, to write explanations, to offer arguments for/against hypothetical responses (p.33).

"**early proofs** (in 2-column format) include an additional 'explanation' column which is a **helpful pedagogical tool to support student thinking and reasoning** through the proof – and can serve as a suggestion for how teachers might want to ask students to craft their own proofs so that the student reasoning is made visible to the teacher" (p34).

"[Alg II] encouraged the **use of technology for graphing**" (p.35).

"[Alg II] **Lots of reference material for students to support prior knowledge**…The course materials are **well-organized and clear to serve students and teachers as a reference** source for times when select students need reminders or to revisit certain ideas" (p35).

"Many of the career-related applications offer **opportunities for students to engage in problem-solving and promote mathematical reasoning**, including some opportunities for reasoning in some interesting contexts (e.g., sudoku, computer programming)" (p.45).

Addressing Limitations Identified

New Features

The evaluation team extracted notable Pathway2Careers Math Curriculum strengths and some limitations. The evaluators recognized that primarily the review was favorable and that the curricula meet a range of complexities and high standard demands. Regarding constraints, NS4ed appreciates the *CRIMSTED* evaluation and has worked to address limitations by adding new features available as early as this summer, 2022.

***Quality of Pedagogical Support**

The *CRIMSTED* evaluation recognized that teacher-specific resources were limited. Pathway2Careers Math Curriculum pedagogical supports were in the final stages of development when the *CRIMSTED* review was taking place. Thus, the *CRIMSTED* evaluation team did not have most of the pedagogical materials that NS4ed now offers and provides. NS4ed has expanded its teacher resources significantly, as evidenced below. In addition to Professional Development services, P2C math teachers are directly supplied with the following pedagogical and P2C implementation support materials:

Pathway2Careers User Guide
Pathway2Careers Math Curriculum Instructional Scope & Sequence
Pathway2Careers Curriculum Standards Crosswalk
Pathway2Careers Teaching Strategies & Guidance
Pathway2Careers Math Course Pacing Guide
Pathway2Careers Math Application Lesson Graphic Organizer
Pathway2Careers Math Exploration Lesson Graphic Organizer
Pathway2Careers Math Vocabulary Graphic Organizer
Pathway2Careers Math Glossary
Pathway2Careers Math Academic Conversation Cards
Pathway2Careers Home Communication Flyer

As a new feature and teacher-specific resource in May 2022, the NS4ed Professional Development Team is releasing a **digital library of 20+ micro-teaching professional learning lessons** on topics including Career-Connected Learning, CCL for Growth, CCL Classroom Assessment, Mathematical Understanding, Career Awareness, Connecting Math & Careers to Performance Case Study, and Instructional Strategies for the Career-Connected Classroom. This quickly growing library was created to strengthen teaching efficacies to support pedagogical best practices, particularly for educators engaging in math education, career & technical education, and career-connected learning.

Further Integration of Technology

Evaluators noted that technology integration was limited when reviewing the P2C Math Curriculum. It should be pointed out that the *CRIMSTED* review specifically reviewed the PDF lesson version. Coming this June 2022, NS4ed is integrating enhanced item types, math tools, and accessibility features. Students working on the digital platform will be able to manipulate virtual tools (rulers, protractors, compasses, *etc*.). They will plot and graph complicated problems and easily access and use math symbols to write out formulas and answers.

References

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