



# CHEVRON ENJOY SCIENCE PROJECT BASELINE EVALUATION **EXECUTIVE SUMMARY**



## **THIRD-PARTY EVALUATION: BACKGROUND**

The Chevron Enjoy Science Project is a \$30 million, five-year, public-private partnership to strengthen Thailand's competitiveness and innovation by improving science, technology, engineering and math (STEM) education, and technical vocational education and training (TVET) across the country. Convening a range of partners in civil society, academia, the private sector, and the government, the Chevron Enjoy Science Project will directly benefit more than 660 schools and 500,000 students, teachers, principals, government education officials, community members, and workers, substantially contributing to an innovation-based economy in Thailand.

In May 2016, Kenan Institute Asia contracted Management Systems International (MSI) to provide third party, external evaluation services to the project, on which Kenan serves as the lead implementing organization. The evaluation team consists of evaluation and education experts from MSI and members of the National Research Team (NRT), including over 50 faculty members and researchers from 15 universities throughout Thailand. MSI and the NRT jointly developed the evaluation design, data collection tools and protocols, and analysis plan to investigate program impact and produce novel research on various aspects of the Thai education system, including student learning, teaching methods, teacher practices, classroom dynamics, school leadership, and professional learning communities (PLCs). The partnership with the NRT also ensures the relevance and sustainability of the project evaluation in the Thai educational context.



## PURPOSE

The purpose of the project evaluation is to deliver rigorous and reliable measurement of program effectiveness in two core programmatic components: STEM (Thai grades 7-9, basic education), TVET (Thai grades 10-12 and 13-14, vocational education). The evaluation examines hypothesized causal pathways between project activities and student and teacher outcomes, including improved teacher practice, improved student engagement and student achievement, and curriculum relevance. Data will be collected at three time points over the course of the project: baseline, midline and endline. This summary presents findings from the baseline evaluation of the Chevron Enjoy Science Project. Findings should be interpreted with caution given this is a baseline assessment of the project and additional observations over time will be obtained to answer the research questions guiding this evaluation and to make more robust assessments of project impact.

*The Chevron Enjoy Science evaluation specifically focuses on the STEM and TVET components and their activities, subdivided as follows:*

### A. STEM COMPONENT

- 1 Does professional development and mentoring of science teachers in the areas of project and inquiry-based learning strengthen teacher engagement and instructional practice?
- 2 Do strengthened curriculum materials and improved teacher engagement and instructional practice lead to increased student interest and engagement in math and science subjects?
- 3 Does improved teacher engagement and instructional practice lead to increased student achievement on national math and science metrics?
- 4 Does increased student achievement in math and science lead to increased selection of STEM / TVET academic tracks?
- 5 Does increased selection of STEM / TVET academic tracks lead to more graduation from STEM / TVET academic tracks?

### B. TVET COMPONENT — STEM FOR TVET ACTIVITY

- 1 Does professional development and mentoring of science teachers in the areas of project and inquiry-based learning strengthen teacher competency and practice?
- 2 Do strengthened curriculum materials lead to increased relevance of the curriculum and improve teacher competency and practice?
- 3 Does increased curriculum relevance and improved teacher practice improve student learning of applied science?

### C. TVET COMPONENT — TECHNICAL TVET ACTIVITY

- 1 Does professional development and curriculum enhancement improve teacher competency?
- 2 Do curriculum enhancements make the curriculum more industry relevant?
- 3 Do improved teacher competency, industry-relevant curriculum, short courses and work placement improve the skills, abilities and experience of students?
- 4 Do improved skills, abilities and experience of students improve their job readiness?
- 5 Does improved job readiness among students improve the perceived quality of labor supply by employers?

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Sakon Nakhon Rajabhat University
Songkhla Rajabhat University
Suranaree University of Technology
Suratthani Rajabhat University
Surindra Rajabhat University
Yala Rajabhat University

## METHODOLOGY & DATA SOURCES

The evaluation utilizes mixed methods—including qualitative and quantitative—to gain a rich understanding of project impact. In this evaluation, the cohort that received Chevron Enjoy Science activities is referred to as the “treatment” group. Schools that did not receive project activities are called “control.” MSI employed principal component analysis (PCA) to explain the interrelationships among a large number of variables using a smaller number of variables. Inferential statistics (t-test) were performed to explore statistically significant differences between treatment and control schools. MSI also ran a difference in differences (DiD) analysis for the STEM component by year.

Primary data for the evaluation consists of student surveys, teacher surveys, classroom observations, focus group discussions, and teacher interviews. For all evaluation areas, quantitative survey data were collected in both treatment and control schools. Classroom observations were also conducted using the UTeach Observational Protocol (UTOP), an observational instrument used to assess the overall quality of classroom instruction. The UTOP was designed by the University of Texas–Austin to evaluate teaching effectiveness while valuing different modes of instruction (UTeach 2017). The UTOP instrument for this evaluation was adapted to fit the Thai education context through extensive piloting prior to deployment.

The evaluation uses Ordinary National Educational Test (O-NET) and Vocational National Educational Test (V-NET) scores as secondary data sources. O-NET measures the academic proficiency of students at the end of general primary, lower secondary and upper secondary levels (Thai grades 6, 9, 12) in five subject groups. The V-NET measures the academic proficiency of students of vocational levels (Thai grades 12, 14). For purposes of this evaluation, O-NET (Thai grade 9) and V-NET (Thai grade 12) correspond to programmatic focus and were utilized. O-NET and V-NET scores will be available after March 2018 to capture post-treatment data and analysis will be presented in the midline and endline evaluation reports.



## SAMPLING AND SCHOOL SELECTION

MSI ran a matching analysis to select treatment and control schools with comparable characteristics. The primary characteristics of treatment and control school were region / province, urban / rural locality, size of school, the administrative oversight authority, and national test scores (O-NET, V-NET). Across 54 provinces in Thailand, 266 schools participated in the study, reaching 14,599 students and 629 teachers. The sample size and strong matching of treatment and control schools allowed for a robust quantitative representative sample of the teacher and student populations in the study as well as broadened the range of possible data and formed a better picture for qualitative analysis.

**TABLE 1: Sample Size**

TOOL	STEM Component		TVET Component			
			STVET Activity		TVET Activity	
	Schools	Observations	Schools	Observations	Schools	Observations
<b>Student survey</b>	206	9,697	60	2,681	41	2,221
<b>Teacher survey</b>	192	406	59	103	40	120
<b>UTOP</b>	215	448	54	94	N/A	N/A
<b>Focus Group Discussion</b>	N/A	N/A	60	61	41	41
<b>Teacher interview</b>	215	448	60	94	41	116

## STAKEHOLDER AND PARTNER ENGAGEMENT

This evaluation effort has been given valuable support from a wide range of stakeholders. The NRT, composed of faculty members and researchers from 15 universities throughout Thailand, played a critical role in collecting, consolidating, and analyzing the data. The National Institute of Educational Testing Service (Public Organization) provided O-NET and V-NET data, allowing this study to be the largest education research evaluation of its kind in Thailand. The Office of Basic Education Commission (OBEC) and the Office of Vocational Education Commission (OVEC) under the Ministry of Education played key roles in reviewing the study design and interpreting results. The Thailand Research Fund, Office of the National Economic and Social Department Board, and a range of universities across Thailand participated in a review of the study design and methodology. Finally, MSI hosted a series of stakeholder interpretation workshops to share preliminary findings and to obtain local interpretation of findings. Moving forward, the evaluation team will continue to rely on the important contributions of these key stakeholders.

## ETHICAL REVIEW AND INSTITUTIONAL REVIEW BOARD (IRB) APPROVAL

MSI obtained approval to conduct evaluation activities from Khon Kaen University’s Institutional Review Board, a committee that reviews research design and data collection, data management, analysis and reporting procedures to ensure ethical treatment of individuals involved in the study. Data collection activities in Khon Kaen served as a pilot of the tools and data management systems that were later implemented in other provinces. MSI also received IRB approval from Chesapeake IRB, a leading accredited review board that has extensive international experience regulating and examining research designs and processes to protect the rights and welfare of human research participants.



## KEY FINDINGS

Overall, the Chevron Enjoy Science project should be encouraged by these baseline results. Where activities have been taking place (STEM and STEM for TVET), the results showed a very positive treatment effect, with the treatment schools outperforming the control schools.

Table 2 presents statistically significant results based on differences observed in three evaluation tools (student survey, teacher survey, classroom observations) between treatment and control schools for STEM and STEM for TVET. For STEM, there were 65 statistically significant results showing a positive effect for the treatments schools and 2 statistically significant results in the control. The item level results for STEM for TVET were similarly positive; the treatment had a statistically significant positive result on 41 items across all three data collection tools while the control had one item that was statistically significant. The components of the Chevron Enjoy Science program (STEM, STEM for TVET, Technical TVET) are all at different stages of implementation. Therefore, it is important to keep in mind the level of treatment received when reviewing results.

**TABLE 2: Statistically Significant Results for STEM and STEM for TVET**

STEM Year 1:	Treatment	Control
Student Survey	2	1
<b>STEM Year 2:</b>		
Student Survey	21	1
Teacher Survey	3	0
UTOP	8	0
<b>STEM Year 3:</b>		
Student Survey	26	0
Teacher Survey	2	0
UTOP	3	0
<b>TOTAL</b>	<b>65</b>	<b>2</b>
<b>STEM for TVET:</b>		
Student Survey	23	1
Teacher Survey	10	0
UTOP	8	0
<b>TOTAL</b>	<b>41</b>	<b>1</b>

## STEM RESULTS

The STEM results are positive. The effect was most prevalent across all cohorts (years 1, 2, 3) in the student survey results, especially with regard to student engagement. The years 2 and 3 cohorts showed statistically significant indicators in the teacher survey and UTOP results.

It should be noted that there were three cohorts of STEM schools participating in the project at the time of data collection. The first cohort of STEM schools (Year 1) participated in program interventions since 2015 and received over two years of support. Year 2 STEM schools received nearly two years of support, and Year 3 schools were beginning to receive support.

### STEM: KEY FINDINGS

- 01**  In all STEM treatment cohorts (years 1, 2, 3), students reported working as part of a team when learning about science, emphasizing the fostering of cooperative learning and promotion of student involvement and engagement in the classroom.
- 02**  In all STEM treatment cohorts (years 1, 2, 3), students reported higher degrees in their “confidence” in math and science content and perceived themselves as being “good” in these subjects. Moreover, a higher percentage of students reported that they will take advanced math and sciences courses, and treatment students from Y1 and Y2 believed that science will help them to get a better job.
- 03**  Across all STEM treatment cohorts, over 70% of teachers utilized inquiry-based teaching methods and laboratory investigations, whereas nearly 50% of teachers in the control employed lecture-based teaching and assigned individual student work.
- 04**  Of all math teachers in the treatment cohorts observed, 29% used group work on meaningful tasks in their instruction whereas only 19% of control cohort teachers utilized group work.
- 05**  A higher percentage of treatment cohort teachers from Y2 facilitated critical thinking by having students conduct their own investigations in science (37% compared to 26% in the control cohort) or employed problem-solving strategies in mathematics (25% compared to 13% in the control cohort).

Interestingly, differences in student engagement, student skills in applied science, and student selection of STEM-related tracks were statistically significant in favor of the treatment group. Students with exposure to teachers participating in Chevron Enjoy Science activities demonstrate a range of positive outcomes from greater participation in math or science-focused extracurricular activities to heightened enthusiasm and excitement about math and science coursework, and appreciation for applications of this knowledge to their daily lives and the world around them.

Results from the classroom observation protocol (UTOP) showed statistically significant differences in lesson structuring were found across all geographic regions of Thailand (north, northeast, central, south) in favor of the treatment group. Finally, qualitative data demonstrated higher percentages of teachers utilizing inquiry-based teaching methods, high-impact teaching practices (i.e. pair and share), laboratory activities, group work, and student engagement.



## STEM FOR TVET RESULTS

After only one year of intervention, the STEM for TVET results showed a strong, positive treatment effect. There were statistically significant results in favor of the treatment in all key indicators and none for the control. Teacher practice showed the strongest results triangulated by three tools (UTOP, teacher survey, student survey).

### STEM FOR TVET: KEY FINDINGS

- 01**  In the treatment cohort, 64% of students reported that science is their “favorite subject” and nearly 90% of students in treatment schools stated that they “enjoy science.” Similarly, 95% of treatment teachers confirmed that they observed students enjoy learning science.
- 02**  In the treatment cohort, 88% of students reported working as part of a team when learning about science, emphasizing the fostering of cooperative learning and promotion of student involvement and engagement in the classroom.
- 03**  As confirmed across three instruments, 84% of treatment teachers related scientific concepts to the world of work, providing relevance to what would otherwise be an abstract subject. Furthermore, 95% of treatment teachers reported relating science learning in the classroom to real-life situations.
- 04**  Classroom observations found that 44% of treatment cohort teachers (compared to 24% of control cohort teachers) used a project-based learning approach.
- 05**  Classroom observations underscored that treatment cohort teachers’ lessons were structured in a way that allowed students to engage and explore deep conceptual learning and supported active participation in classrooms (67% of treatment cohort compared to 42% in the control cohort).

Exploration of the STEM for TVET data reveals that science instructors in TVET schools typically receive very little professional development related to their field of expertise, and that the key activities implemented to date have already had a strong impact on teachers and students. Qualitative data obtained highlighted the relevance of science concepts taught to the world of work, increasing student motivation to learn by providing relevance to what would otherwise be an abstract subject. The treatment group had a much greater frequency (70% to 37%) of using workplace case studies and materials to demonstrate scientific concepts. Furthermore, nearly 95% of treatment teachers (compared to 70% of control) explained the real world application of the lesson to the class, thus providing more industry-relevant knowledge and skills.

The qualitative data gathered from teacher interviews and student focus groups also provided strong evidence in favor of the active learning approach of Chevron Enjoy Science schools compared to more traditional, lecture-based approaches typically used in control schools. Science laboratory activities were the most-mentioned preferred method of learning by students across both treatment and control schools. Finally, treatment teachers most frequently assigned exercises involving active student participation in group work, while control teachers mostly assigned work to be done individually in class.

## TECHNICAL TVET RESULTS

The Technical TVET component results are a baseline of this data collection, and this bears out in the data. There was one statistically significant indicator (teacher survey), and it favored the control. This shows that the schools are well matched for further investigation at midline and endline.

*A full copy of the baseline evaluation report can be found at <http://www.enjoy-science.org/me/>*

### THE CHEVRON ENJOY SCIENCE PARTNERSHIP

