Principles and Practices Core to the Success of the Constructionist Movement in Thailand

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November 2020

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This work was funded by the Candlelight Project, with support from the Suksapattana Foundation.

Any opinions, findings, and conclusions or recommendations expressed in this paper are those of the authors and do not necessarily reflect the views of the Suksapattana Foundation, Teachers College, Columbia University, or Utah State University.

We would like to thank Nalin Tutiyaphuengprasert and Arnan Sipitikiat for their valuable feedback on our writing. We are most indebted to the many people who shared about their experiences with Constructionism.

Table of Contents

Abstract

Thai Constructionism as a Landmark for the International Community

Research findings reveal in Thailand what is most likely the longest continuous Constructionist implementation in the world—one extending beyond pre-university education into community development projects and corporate business practices, and one that has entirely unique characteristics. Nowhere else have the principles of Constructionism been applied for so long, in such a wide range of institutions, and with such intentionality, persistence, and conscious incorporation of local cultural practices and beliefs.

For these reasons, Thai Constructionism offers lessons to inspire community leaders, teachers, and business people internationally, and provides leadership on the path to real transformation in how the world integrates community and personal development, education, technologies, and powerful ideas.

Work of the Suksapattana Foundation and Primary Findings

The 24-year history of the Constructionism movement in Thailand, with particular emphasis on how the ideas of Constructionism have been adapted and implemented by the Suksapattana Foundation, was researched by a team of Columbia University scholars over a four-year period of intensive field data collection and analysis.

The primary findings of that research are presented in this document and are organized along the following three main categories and sub-sections:

Principles of "Thai Constructionism"

- Start with People's Interests or Problems
- Learner Agency
- Reflection as a Core Practice
- "Low Ego" Approach to Mistakes
- Connect with Spirituality through Meditation

Core Attributes of Past and Future Successes

- Deep Internalization/Personal Transformation
- Long-Term Mentorship and "Thinking Alongside"
- Just-in-Time Resources
- Bridging Communities, or "Brokering"

Overcoming Obstacles in the Implementation of Constructionism in Thailand

- Maintaining Stability Despite Changing Institutional Leadership
- Importance of Leaders who Understand Constructionism Deeply
- Benefits and Limitations of Technology Workshops
- Navigating Formal Schooling with Learner-Driven Projects

Introduction

Mandate of this Report

Organization of Findings

A Brief History of Constructionism in Thailand

In December 2017, we set out to document and understand the depth and breadth of the work of Constructionism in Thailand, particularly as the ideas of Constructionism have been adapted and implemented through the Suksapattana Foundation. We researched the 24-year history of the movement, from its origins with the invitation to bring Seymour Papert to Thailand in 1996 to the current times. We wanted to understand how people interpret and implement Constructionism nowadays in various areas of Thailand, from schools and villages to farms and businesses.

To do this we made four research trips to Thailand—in December 2017, June 2018, August 2019, and January 2020. The primary means of collecting data on this project was through interviewing key stakeholders and participants during those trips, from some of the originators of the movement to long-time and more recent leaders. We sought to interview those leading, learning, and implementing Constructionism across the country. This pursuit also led us to interview some additional people over the phone, including one of the original MIT students (now a professor) who had led workshops in Thailand in the early years. In the end, we interviewed 61 participants for a total of 107 hours, in both Thai and English, with translators present as needed. The interviews were supplemented with some observations and documents about the Constructionist movement in Thailand, including extensive written notes by Khun Bangkok Chowkwanyun, Suksapattana Foundation reports from 1997-2005, and a book published by UNICEF written in cooperation with the Foundation and one of the villages in the study.

These data provided us with a comprehensive depiction of the trajectory of Constructionism in Thailand, its origins, inspiration, history, and impact. The findings reveal what is probably the longest continuous Constructionist implementation in the world, with unique characteristics. We believe that this report will be both beneficial to future developments in Thailand, and will help spread the word internationally about the incredible work continuing in Thailand for almost three decades.

Mandate of this Report

The Suksapattana Foundation's work in Thailand is extensive, with over a hundred workshops led, hundreds of people trained, several organizations engaged in learning, and many institutions who provided resources and volunteers. There are also immense intangibles that have shaped the Constructionist movement in Thailand: mentoring conversations conducted, encouragement given, friendships established, pathways opened. At the outset of this project, we were given some core goals by the Foundation's leaders to guide the examination of this rich history. Namely, we were asked to present findings that would:

- Be beneficial to the international Constructionist community by guiding the Constructionist community of scholars and leaders around the world to grow in their own theory and practice,
- Be useful and applicable to educators around the world that have not yet adopted Constructionism,
- Help the Suksapattana Foundation members understand the effect of the Thai Constructionist movement they began, by demonstrating the roots of its success and the challenges that lie ahead.

While examining this history and data, our research focused on:

1. The core values of the Constructionist community in Thailand
2. The design elements of the project and the forms of implementation that have sustained that community over time
3. Specific contexts of growth from across the three main areas of implementation (communities, schools, industry).

However, the report also has limitations that stem from its mandate and from the constraints of working on a long-term project with hundreds of people. Although we strived for a representative group, we were unable to reach all project participants, since some are no longer available or traceable. Also, the evaluation we conducted was based on interviews and project documents, but not on an independent assessment of quantitative/economic outputs of the projects in the villages or industries, which would have been beyond the scope of our particular study. We also tried to avoid bias in our interpretation and in the interviews by carefully following all U.S. Institutional Review Board (IRB) procedures concerning the protection of human subjects, assuring interviewee confidentiality, and triangulating information from multiple sources.

Thus, this report should not be read as a complete narrative of the entire history of the Constructionist project in Thailand, but rather as an account of principles that guided its development, obstacles faced by the

participants, and lessons that could be inspirational and useful for new phases of the project—all of which are set against historical and cultural backgrounds. In our experience, due to their complexity and focus on implementation, most education development projects around the world never have the resources or time to conduct this type of detailed research on results and lessons learned. Therefore, we believe that this will not only serve the Foundation in Thailand, but many other institutions around the world as well.

In this research, in addition to our compliance with the policies for the protection of human subjects from Columbia University's Institutional Review Board, we also strived to employ the most appropriate and current research methodologies for the task at hand. This has ensured that the data and findings would be fit for publication in international conferences and journals. Nevertheless, as is the case with any report on complex social interventions, our document cannot make absolute causal claims about the observed results. We can offer informed and evidence-based interpretations of the facts and point to the most likely explanations, but we cannot assert that a given action did in fact generate a specific outcome, nor make predictions that similar actions will produce the same results in the future. Many of the actions and outcomes described herein are heavily context-dependent, so changes in the social, cultural, and economic situation of Thailand, as well as in the project's team and stakeholders, would impact future results. That is why this report should not be read as a "formula" for success, but more as a guide and reference for future project leaders.

Organization of findings

Our findings are grouped into three main categories:

1. Principles of "Thai Constructionism,"
2. Core attributes of past and future successes, and
3. Overcoming obstacles faced in the implementation of Constructionism in Thailand.

Such a structure should provide a clear understanding of the causal chain between how the ideas of Constructionism were interpreted and resignified within the Thai culture, how that enabled a unique formulation of the actions in the villages, schools and corporations, and how those point to future possibilities in the country.

A Brief History of Constructionism in Thailand

The Constructionist project in Thailand dates back to the mid-1990s, coinciding with the Asian economic bubble burst of 1997. A series of contacts and meetings between the Thai MIT Alumni Association and **Prof. Seymour Papert** revealed mutual interest in starting a project around educational reform and development in Thailand. The Foundation was looking forward to bringing new ideas and educational methods to a country that had aspirations to quickly move to a new stage in its national development, based on a strong knowledge economy, better educated and more creative citizens, and intensive use of digital technologies. The **Media Lab at the Massachusetts Institute of Technology (MIT)**[1] also had considerable interest in extending its emergent ideas on Constructionist learning to new countries and cultures. In 1996, Seymour Papert visited Thailand for the first time, and an initial workshop was organized the following year. The project grew quickly and a formal five-year plan was created (the **"Lighthouse Project"**). Several MIT Media Lab professors, led by Papert's team, took part in the project, and MIT students and faculty, along with Thai partners, led multiple workshops in Thailand.

In a February 1997 letter to H.E. Dr. Chaovana Nasylvanta Seymour Papert outlined the principles of the proposed endeavor (NEC Appendices, 1997). *One of those ended up being a fundamental pillar of the work conducted over the next 20 years: the goal was not to import and implement a ready-made project from the United States, but for the Thais to construct their own understandings about learning, technology, and Constructionism.* In that sense, Papert's team intentionally left many open spaces for local sense-making and co-construction—a decision that had a lasting impact in the project's future. *After a series of workshops, extensive correspondence, and numerous visits, the formal MIT-led part of the project ended in 2001.*

Thus, the project was firmly rooted in Thailand, and the local project leaders were inspired to keep going. The work then continued organically, with setbacks resulting in new innovations and leading in new directions of Constructionism previously unexplored elsewhere in the world. Project members conducted workshops across Thailand and expanded the scope of the project beyond schools to corporations and villages. An important development around that time was the establishment of the first Constructionist school in Thailand, one of the first in the world. The **Darunsikkhalai School of**

[1] We will often refer in this report to Papert's team at the Media Lab at the Massachusetts Institute of Technology as the "MIT team" or "MIT".

Innovative Learning (DSIL) was, and continues to be, one of the most transformative schools worldwide, with its pioneering structure and curriculum. It also serves as a training base for many Thai Constructionist leaders, who intern there for several months, learning from the DSIL teachers about how to facilitate learning in a Constructionist manner.

Because of the strong focus placed on creating local capacity and generating local formulations of Constructionism, after 2001 the project team in Thailand was able to overcome numerous roadblocks. Over the next several years, they would have to deal with changes in the Thai economy and society, new project leadership, and novel funding issues—all difficulties expected in projects concerning educational reform and development. The emphasis on locally responsive integration, rather than a mere transposition of a US-based project, enabled a deep reinterpretation of Constructionist principles within Thai culture, and many creative and bespoke solutions were conceived.

An example here is the changes that happened after the first wave of teacher-focused workshops in Thailand. One of the first phases of the effort to spread Constructionism in Thailand involved workshops for 80 teachers—two each from 40 schools. While those teachers reported valuing highly this new type of learning, follow-up conducted by Foundation leaders revealed that teachers were not implementing Constructionism in their classes, largely because of systemic, top-down constraints placed on school learning. Once the Foundation became aware of this, it switched gears, shifting toward areas of greater openness to new learning, by:

1. strengthening their partnership with non-formal education centers in Thailand, thus directly impacting individual villages,
2. continuing to find openings in industry to invigorate technicians' learning and problem-solving ability on the ground level of various industrial plants,
3. opening their own Constructionist-based school (the aforementioned DSIL) that proved so transformative at many levels.

Thus, the initial roadblock led to finding other areas open to new philosophies of learning, resulting in deep innovation unique to Thailand.

Findings: Principles of Thai Constructionism

Start with People's Interests or Problems

Learner Agency

Reflection as a Core Practice

"Low Ego" Approach to Mistakes

Connect with Spirituality through Meditation

A central feature of the project was the deep reinterpretation of the ideas of Papert and his collaborators within the Thai context. The need to allow for this reframing is explicit in the "founding" documents of the project, such as Prof. Papert's November 1997 letter to H.E. Dr. Chaovana Nasylvanta. There, he explicitly states that:

> *"... the proper formulation of the goal of the projects I recommend is not 'transfer of computer technology' but 'growing a new, specifically Thai, computer culture'"*

On the Thai side, there was also great concern about not simply copying MIT's ideas, but creating local and enriched adaptations and combinations. This is clear, for example, in documents written by Foundation leaders and in reports such as that produced for the DSIL school, in which school leaders describe in detail their own "version" of Constructionism (Lighthouse Report, 2006, p. 17). The willingness of both sides (MIT and Thai teams) to fuse practices and knowledge was undoubtedly one of the most unique and successful aspects of the project. Below we summarize five of the main themes of Thai Constructionism, as communicated to us in interviews and documents.

Start with People's Interests or Problems

The concept that learning should emerge from people's interests is core to both classic and Thai Constructionism, but has been applied in Thailand with extreme patience and persistence over multiple decades. To our knowledge, *this has never been documented anywhere else in the world in such an intentional and consistent way*. For instance, even though Foundation members may have had an approximate idea as to what a village, business, or school might need, they still organized sessions to listen to people's perceived needs and interests before any action would be taken. Such needs were not assumed— learners were always given a voice to present and explain their issues and interests. This paid off over the course of many years in the ownership people took over researching and working on their own problems, and in the way one interest led to another.

Such a patient approach could be seen in some of the interest-driven work in villages. Even though Foundation leaders knew of ways in which villages could improve their living situations, they encouraged the villagers to focus on their felt problems first. For instance, the main felt problem of one village was the mountain of financial debt faced by its members; the villagers spent several years (1998-2003 / B.E. 2541-2546) researching their debt first at the village level and then within small groups with members from each family in the village. They received assistance from the Foundation, which provided knowledge and support for household accounting programs—first using pen and paper, and later Excel spreadsheets. Only once the villagers had gained a solid understanding of their finances and started formal savings programs, did they begin to realize that developing a better water management system would support their larger goals of greater prosperity.

> *"After the research of 2544 [on finances], we knew that our income mostly came from the environment, the forests and mountains. When we knew where the money came from, we became interested in the environment. It started after the research, the research told us to do so." (Pimchan, January 2020)*

So at the villagers' initiative, the Foundation introduced them to the Chiang Rai sustainable water management system involving check dams. Even then the village did not start applying that knowledge. It wasn't until a forest fire near the school happened that the schoolchildren became motivated to begin making check dams, eventually involving their parents in their work. Unfortunately, the initial dams failed because they had been built at the bottom of the mountain rather than at its top. However, that failure led the villagers to seek more formal knowledge and engineering support from the Foundation, which in turn resulted in a more knowledgeable, well-planned, and sustainable approach to water management—one that has since become an exemplar in Thailand.

Reflection

Showing patience in focusing on learners' interests and perceived problems is core to the sustainability and longevity of many of the Foundation's most celebrated examples of their work.

Learner Agency

A core feature of both classic and Thai Constructionism, learner agency has been applied in many more areas of society in Thailand than in other Constructionist environments we are aware of. The learners are always in charge of leading the work on their problems and interests. Even though this principle has been adopted into many other Constructionist experiences around the world, it was mostly limited to schools and classrooms, but not applied to villages, corporations, or other environments. In Thai Constructionism, learning went beyond the school, and the concept of the learner was expanded beyond schoolchildren to include all members of the community, independently of age or position. This is crucial because, by recognizing any community member as a learner, the project allowed the principles and lessons from the original Constructionist work with children to be widely applicable among all members of society.

One core innovation in the Thai embodiment of learner agency lies in *the creation of the abbreviation "Fa" for Facilitator, which embodies the idea of walking alongside, rather than that of telling or directing.* This intentional introduction of a new honorific demonstrates a thoughtful formality to codifying the idea of learner agency. The honorific of "Teacher" came with too many familiar expectations of directing others' learning for them in a hierarchical manner. Thus, Facilitators are not teachers, but support learning in a different way. Similarly, usage of the honorific "Fa" helped to make people from vastly different areas of Thai society equally valued in regard to Constructionism. People titled Facilitator/Fa included both Vice Presidents of well-known companies and villagers with no formal degrees or education. In the context of Constructionism, all Facilitators had knowledge and wisdom to share.

Moreover, when Facilitators deeply internalized the idea that learners need to take agency and direct their own learning, this had a cascading benefit in developing other learners. As an example, Saijai, a Facilitator in her village, experienced two core years of mentorship that supported her own development of learner agency. In turn, she took on a similar role with others in her village:

> *"People have to investigate their own area and fully participate in data collection, analysis and learning this process together. We didn't do a project for them, they have to do it by themselves with our support." (Saijai, Dec 2017)*

In other words, Saijai was treated as an agent of her own learning, and she took that to heart in training others in her village.

Reflection

The concept of facilitating learner agency, codified in the honorific "Fa", is core to the personal transformation that people experienced in taking ownership of their problems, which in turn supported a cascading form of facilitative leadership.

Reflection as a Core Practice

Despite the importance given to personal reflection in classic Constructionism, in many real-world implementations it ends up being an aside, often overlooked in favor of doing projects. However, in Thai Constructionism, reflection has become a conscious and intentional practice that interviewees universally articulated as transformative and as giving them power to persevere. Reflection is a core practice taught and modeled in workshops, and many participants mentioned key phrases that they had internalized, including *"think-do-reflect"* or *"reflection, reflection, reflection"*. Even the lead facilitators of workshops and educational efforts discussed how reflection helped them improve their own facilitation!

Internalizing reflection helped people evaluate the research and projects they had done, and think through what had gone well, what could be improved, and how to proceed. One village leader explained to us how transformative reflection was in village life. Before the introduction of Constructionism, when the village would try to solve problems, their thought processes and discussions were "scattered and unorganized, not systematic". However, as another villager explained, *having a "reflection period" after actions helped the village to recognize things that made later projects more successful*. For instance, in their water management efforts, a reflection period helped the villagers realize that building check dams to slow the flow of water was not enough, they also had to work on fire prevention: "both have to be done at the same time." Now the village reflects on every initiative they take, from working with parents and children in education, to evaluating building projects, to judging their agriculture initiatives. This has made them "more thoughtful and precise" and has improved their abilities to solve problems and, as discussed next, work through mistakes.

Reflection

The interplay between "thinking" and "doing" has been one of the gaps in Constructionist practice in the West. On the other hand, Thai Constructionism executes this with unprecedented focus, encoding it in clearly delineated thought processes adopted across the board by the participants we interviewed.

"Low Ego" Approach to Mistakes

Debugging and working through mistakes as a way of learning was a core feature of Papert's work. In classic Constructionism, debugging was very much related to computer programming, and later to robotics—it was rarely applied more broadly into out-of-school activities and areas where technology was not densely present. In Thailand, again, these notions were expanded and strengthened, and the idea of working through mistakes—rather than being blocked by them—was central. Almost everyone we interviewed, including more peripheral Constructionist participants, *assumed that their first efforts would not go smoothly*: they knew there would always be room for improvement. People spoke of their mistakes as signs of learning, not as deficiencies. In projects as diverse as lesson plans, check dams, water towers, farming, and teacher professional development, there were always opportunities to reflect and learn from mistakes, and then go on to work towards a better version. Even the core leadership of the Foundation pointed out things that had not gone well, and how they responded by reflecting, iterating, and improving on their practice.

The idea of mistakes being a key part of the learning process was associated with the spiritual (Buddhist) attribute of humility. As one core Foundation leader told us,

> *"You need to accept what you are not good at and recognize your mistakes. As for me, even though I have much experience for over 20 years [in Constructionism], I have more mistakes than successes." (Worawech, June 2018)*

He believed it was important to "put your ego aside" in order to work alongside learners. Another leader encoded this in his writing on Constructionism, explaining that

> *"At the heart of the Fa concept is "Low Ego"; Low Ego is at the heart of Constructionism, and the Fa need[s] this to be an effective Constructionist Teacher (and Learner)." (Pricha, June 2018)*

Both leaders reinforced the importance of facilitators (Fa) having low egos, learning from their own mistakes, and thus growing alongside rather than over their learners.

Reflection

The universality of the practice of working through and valuing mistakes as part of the learning process demonstrates the core importance and power of this element in Thai Constructionism. It also demonstrates how much further this idea has been developed beyond classic Constructionism, as well as the conscious connection Foundation leaders made to Buddhist spirituality.

Connect with Spirituality through Meditation

Even though Thai Constructionism extended and improved upon many original Constructionist practices, there was one area of thoroughly original development: *the incorporation of spirituality, largely in the form of meditation* (and also through values such as Low Ego as discussed above). This was actually one of the most unique aspects of the Thai reinterpretation of Constructionism. It was done consciously, particularly by one key Foundation member with a strong spiritual practice, who noted that the Constructionism introduced by MIT was *missing* a spiritual connection. This was a critical finding: since the roots of classic Constructionism are so connected to digital technologies, they would seem to be at odds with deeply "analog" and "no-tech" practices such as meditation—but that was not the case in Thailand. In very creative ways, Thai project participants and leaders independently recognized aspects of Constructionism that corresponded to elements of Buddhist practice.

One core use of meditation was to manage emotions, especially in response to mistakes and constructive criticism. As one facilitator, Boonmee, explained,

> *"If you can't control your mindfulness, you will get angry and you can't think thoroughly about the cause of the problem you made."*
> *(Boonmee, Dec. 2017)*

Boonmee described how before hearing about Constructionism, he used to have a very short temper and had been particularly unreceptive when people criticized his teaching. But after learning to apply Constructionism, he reported being calmer and more thoughtful about other people's perspectives. Similarly, one of the industry leaders we spoke with explained that the "soft skills" or "inner tools" of Constructionism, which meditation can train—such as inner drive, mental concentration, empathy, and peace—were far more important and long-lasting than technology, which changes rapidly.

> *"I view that mind focus is one of the primary tools in Constructionism to develop students... once our minds are calm, we will have the ability to think, especially in innovation."*
> *(Mana, June 2018)*

He believed that this applied regardless of nationality or religion, and that it would outlast any changes in technology, since the inner tools are "timeless".

This integration of spirituality uniquely equipped Thai Constructionists to listen better to others (e.g., for collaboration), to manage emotions (e.g., when receiving constructive criticism), to seek understanding of their problems (e.g., their "suffering"), and to look out for the good of others and not just themselves. This contributed to an especially community-oriented Constructionism, less individualistic and more focused on the common good than that discussed in most Constructionist literature that we are aware of.

Reflection

The integration of spirituality and "inner tools" into core aspects of Constructionism is uniquely Thai. They have been consciously thought out and integrated into practice. These are significant contributions to the philosophy and theory of Constructionism worldwide.

Findings:
Core Practices of Success

Deep Internalization / Personal Transformation

Long-Term Mentorship and "Thinking Alongside"

Just-in-Time Resources

Bridging Communities, or "Brokering"

"Constructionism is like growing a tree. It takes time."

~ Mana, industry educator, 2017

One of the central goals of this report is to identify the core practices that led Thai Constructionism to its two-decade success story. Recognizing these would enable not only the expansion and continuation of the project in Thailand, but also provide clues for how it could be applied in or communicated to other countries. A deep understanding of these core practices can also inform the different institutions, leaders, and teachers in Thailand about what led to the powerful incorporation of Constructionism there in the first place.

In this section, we discuss some of the key practices that led to the success of the project, always keeping in mind that, consistent with Constructionist principles, these are not a recipe for success, but rather a roadmap to understand the complex ways in which the project was implemented in Thailand.

Deep Internalization / Personal Transformation

One underlying success of the Thai Constructionist movement is that many people experienced such deep, personal transformation through Constructionism that they applied it outside of their primary workplaces and persevered in using it even when faced with obstacles, such as those discussed below. In other words, they not only used it in reshaping their farming, industry, or education practices, but also in their personal lives, in shifts to new workplaces, and in shifts within evolving workplaces. This is one of the core means of continuation in the Thai Constructionist movement.

Consider Manoon, who first learned Constructionism in his industrial workplace and helped technicians in his workplace learn and apply it. However, he later took on a new job in another area of Thailand. There was little room to spread Constructionism directly in his workplace, so instead he used it in his corporate social responsibility (CSR) work in a village sponsored by his company. He worked with the villagers in an outrightly Constructionist way, thinking alongside them as they identified problems, sought how to solve those problems (through soil analysis and new cash crops), and reflected on both their progress and mistakes. Throughout it all he emphasized the villagers' ownership of their own work and learning.

Parents also introduced their children to Constructionism to help them develop deeper "life goals" and to think for themselves. Pinit, a former technician who learned Constructionism in his workplace, found that his daughter was listless and unfocused in school. So he introduced Constructionist practices in his family, encouraging her to take ownership of her learning. He credits this with her subsequent success and interest in her life goals, which led her to a prestigious college.

Others also found new ways to apply Constructionism. When the principal at her

school changed, Teacher Samorn sought to apply Constructionism with her students in the new subject area to which she was assigned (meditation). Upon retirement, she applied Constructionism in her adult meditation classes. She kept an active journal of reflections and mind-maps for her own continued learning.

Multiple farmers in different villages explained to us that once they had done several Constructionist projects on their own (like farming or water management), they continued to apply Constructionism in their approach to other problems, such as market research on vegetables, cost/benefit analysis of a new rice mill, or dealing with a particularly hot growing season.

This deep internalization also spread to others mentored by the participants. Teachers reported that students returned years after their education was over to say how much they had gained from their Constructionist-based classes: that they had the ability to make decisions, to learn how to learn, and to take an active approach to their own learning. Villagers mentored other villagers, who in turn mentored still others.

Reflection

The depth to which people internalized Constructionism meant that their work did not end when an organization's formal commitment stopped, when a supportive leader moved, or when a project was completed. Thus, the Foundation's greatest success, beyond any particular organizational impact, has been the people who continue to practice and learn Constructionism throughout and across their lives.

Long-Term Mentorship and "Thinking Alongside"

Multi-year, or even multi-*decade* mentorship was one key practice that supported the deep personal transformation and internalization of Constructionism in Thailand. A few individuals in the Thai community stood out as long-term mentors/facilitators who took the time to speak to other participants regularly, sometimes daily, over many months or even years. Moreover, this type of mentorship was not about "telling" learners what to do, but rather would focus on supporting discussions of problems and ideas—a prime example of supporting learner agency and learning from mistakes. The mentors never directly told their mentees how to research or solve a problem, but instead asked questions, shared ideas, even presented their own challenges to mentees to elicit ideas from them. This type of work is rarely mentioned in executive reports in any organization because it takes place over such long periods of time and cannot be listed as a singular expense or effort. Yet *it is utterly essential* to the transformative nature of the Constructionist work in Thailand. Below we provide three examples of long-term "thinking alongside" mentorship.

The first example we share is of one non-formal education leader who mentored a Constructionist leader in a village and, in some respects, the entire village itself, for over 18+ years. The relationship began when some of the villagers brought a few young people to attend a computer workshop at the non-formal center. The mentorship began immediately, as a villager recounted:

"In the evening, every evening if he was at the lab, [the non-formal leader] talked with me, asking "What do you think? What do you get from the students? From everyone today? How are your students? How are the parents?" … And he showed and shared with me every night. Even if he had a meeting in Bangkok, he came back and took time to reflect with me."
(Pimchan, Dec. 2017)

This regular reflection became a common practice after the workshop, supported by donated cell phones, and supplemented with more than 150 in-person visits to the village over the course of two decades. Remarkably, the leader never told the villagers what to do.

"He never stopped us from doing anything, only encouraged us to do things or to talk more."
(Pimchan, Jan. 2020)

Instead, the leader helped the villagers to see things from other perspectives, asked questions, and helped them reflect on how things were going. He shared his own reflection diary as an example, one which Pimchan and her students followed for many years. Thus, the leader modeled his own reflection and supported that of the villagers step by step over the decades.

Mentorship happened not only over long periods of time, but in some instances was very deep. In the second example, we share how a different Foundation leader spent many months at a time in another village. One aspect of his effort involved one-on-one tutoring of individual villagers who showed a willingness to learn. Na Song, a local farmer who experienced this mentorship, explained to us that this was very intensive for him, often starting at 8pm and going until 2 or 3am, many nights a week over several months. The Foundation leader and Na Song worked on spreadsheets, mathematical thinking, and agricultural planning. In the early stages, this tutoring involved thinking through questions like "if we start with 10 cows now, how many cows will we have in 15 years?" For a villager with little formal schooling, learning this type of complex, mathematically-rich, systems thinking took a great deal of time and effort. Eventually, the mentorship brought up more complex and systematic planning, such as "what to grow each year continuously for 4 years." Years later, Na Song has internalized this learning and continues to use spreadsheets to track expenses, plan agriculture, and systematically plan for the future. He applied this mentorship practice with his own two children, and his financial planning further allowed him to put both of his children through high school and college—something he previously thought only "rich people" could do. Meanwhile, he and his children have taken up the Thai Constructionist principle of contributing to their community, just as the Foundation leader had done for them.

Our third example illustrates mentorship at an institutional level. Here, one public school principal sought to support each teacher's creativity, while seeking to create a learning community between the teachers. Each grade level was given liberty to figure out how to implement Constructionism, rather than choosing one model and following it across the school.

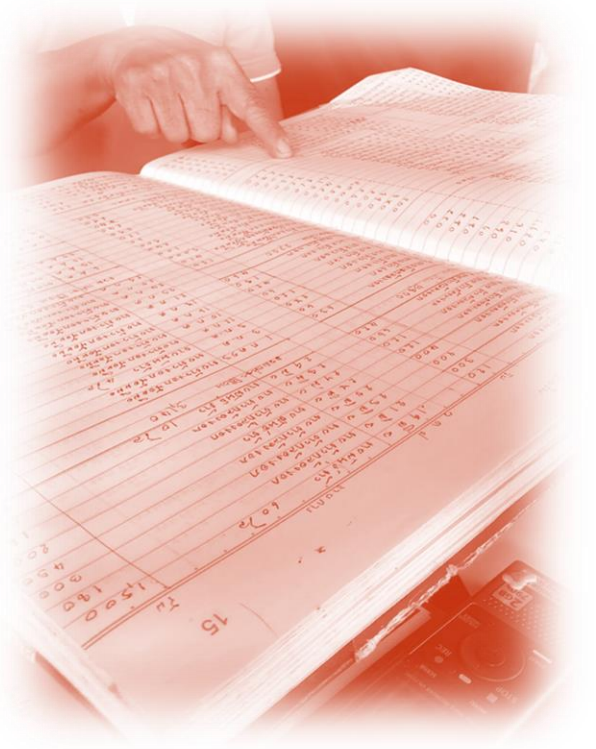
"I just allowed everyone their freedom, gave them the opportunity and space to think on how they could develop the students to their highest potential. But we would learn how to do it together. And I learned from the work of students from activities the teachers arranged."
(Kannika, Jan. 2020)

Together the teachers planned, implemented, shared, and reflected. Each grade level came up with a different model of how to integrate Constructionism, and the teachers learned from each other. Besides providing a strong learning model for the school itself, the approach also supported deep learning in the individual teachers. One of the teachers reported that through her own learning process she came to deeply believe in the process of Constructionism: she gained new insights into her students and they were more interested and learned better. Later, when the principal left, the new one no longer allowed teachers to outrightly practice Constructionism, but the teacher's practice continued in the meditation classes she led outside of school. Thus, the original principal's mentorship allowed for deep transformation in individual teachers who continued to apply Constructionism in new areas of their lives after obstacles arose in their schools.

Many interviewed participants shared that—outside of a few quick adopters—Constructionism takes years for people to internalize, up to 5-10 years in some instances. Yet, the testimonials of deep personal transformation suggest that this is a worthwhile wait and investment.

Reflection

Long-term, "thinking alongside" mentorship provided learners with continuing support for their own development: participants were not left to figure out how to apply Constructionism on their own, but neither were they told what to do. Further, some deeply mentored participants became long-term mentors themselves, walking alongside others in their villages, classes, or businesses. It is vitally important not to disregard this type of work just because it is subtle, quiet, and done over years. We have not seen this type of effort mentioned in any Foundation report, yet it seems essential to the generations-long success of the Thai Constructionist movement.



Just-in-Time Resources

The changes in villages, schools, and companies would not have been possible without the resources of knowledge and expertise, materials (from chainsaws to used computers to satellite imagery), technology, and funding. One crucial element is that resources were not introduced before communities were ready; instead, they came "just-in-time" or at the time of need. To illustrate this we refer back to the in-depth focus on one village's learning trajectory begun in the earlier section under *"Start with People's Interests or Problems"*.

After the multi-year research into their village and household finances, the forest fire near the school, and the children's initial work to build check dams, the village came together in a more organized fashion and together built 20 check dams in one year (2003). Unfortunately, these dams were built low on the mountain and during the next rainy season, the force of the water blew them out and destroyed the work. However, this setback proved to be a productive learning moment, and provided an opportunity for the Foundation to connect the village to key resources that helped them make a more robust water management plan.

Using reflection to consider their mistakes and move forward, the village sought out more expertise. The Foundation helped link the villagers to knowledge and technology that helped them to build check dams more strategically. Some of this expertise came from NECTEC (a government organization) in the form of satellite footage that, along with a village-led forest survey (likely with supportive expertise brokered by the Foundation), allowed the villagers to think more strategically about check dam placement. This new approach to check dam placement meant that villagers needed to start at the top of the mountain, an effort that required more intensive physical labor and tools. The village requested funds from the Foundation to 1) support village men to take time off of work to provide labor, and 2) provide for tools and materials such as used chainsaws, cement mix, and so forth for check dams that required more robust construction.

In 2004, check dam building looked very different from just a year prior. Villagers invested time, effort, and materials. This was supplemented by volunteers from nearby industrial plants, and corporate social responsibility (CSR) resources such as cement. The Foundation brokered connections with the Huai Hong Krai Royal Development Study Center to provide seminars on firebreaks and fire prevention. Other organizations provided knowledge about weather monitoring and GPS training, whose importance was twofold. First, a local woman was able to transfer village map surveys onto GPS maps. Then a group of people, including village adults and youth, the local non-formal educator in Lampang, and technological experts (HAII), created a means of recording the precise locations of check dams on GPS maps—in essence developing village capacity for formal data collection. In addition, the village developed a system and protocol for fire prevention: using GPS to locate wildfires during patrols, coordinating via radio broadcasts, putting up posters about fire prevention, and so forth.

The water management work in this and other villages would not have been possible without the introduction of professional engineers and GPS or satellite imagery. Helpfully, these resources came only when the villagers (in multiple villages) had made some efforts to create their own water management systems that had failed at least in part. They sought out and were ready for new knowledge and technology. This type of progression supported villager ownership, agency, and learning, yet also provided outside resources essential to supplement their knowledge.

Reflection

"Just in time" or "in the time of need" resources are key to supporting learner agency, ownership, and learning. It is equally important to recognize that many of the Thai Constructionist movement's accomplishments could not be accomplished without these resources, and further that the timing of providing them is just as important as their provision.

Bridging Communities, or "Brokering"

One of the key roles of Foundation leadership was that of "broker": building bridges across communities. Foundation leaders:

- helped foster relationships that provided material, knowledge, technological, and financial resources,
- cut through bureaucratic barriers that had been hindering change,
- helped villages make connections to businesses, and even apply for awards and commendations, and
- linked people with mentors.

Many of the dramatic changes reported by village, school, and industry leaders would not have been possible without these connections. This was further facilitated by Foundation leaders who were humble mentors that walked alongside people over years and decades. This meant they understood the problems that people faced in their everyday lives and workplaces, and built trust with these Constructionist learners. Such strong relationships allowed brokers to create connections that facilitated deep-rooted change.

This model of brokering resources differed from the accepted norm. There was never a direct funding approach where people received a budget to spend, as might be the case with a government project that would be otherwise "hands off". Instead, the Foundation paid for travel to support learning, raised funds for

infrastructure (e.g., buildings, computer labs, water management materials, and occasionally remuneration). This type of support—brokering resources just in time—shows the highly involved commitment of Foundation members, as they chose to *partner alongside* communities rather than to perceive their role as limited to simply delivering knowledge and/or funding.

Besides the resources of knowledge, materials, and funding, the Foundation encouraged and helped people to apply for awards and grants for their work. Awards can serve as cultural capital—public recognition that can help persuade others of the legitimacy of an approach. In villages awards for water management, for environmental conservation, and even for mentoring other villages legitimized their Constructionist work in the eyes of others in their village and those in neighboring villages. In schools, awards sometimes made a difference by helping a particular teacher gain the respect of other teachers or parents who did not previously trust a non-traditional approach. Although of course the most persuasive evidence for Constructionism should be its results, in some cases people might pay more attention or be more open-minded when awards provide a broader cultural legitimacy. Similarly, grants provided both funding and cultural legitimacy that helped expand village, school, and industry work.

Reflection

The Foundation's role as a broker and community builder was crucial. It was also coherent with the ideas of Constructionism. Instead of providing ready-made solutions, the Foundation's unique approach was to bring together stakeholders, experts, funders, villagers, and educators, and create an environment in which these relationships would thrive and solidify. As a result, projects became more independent of the Foundation, and stakeholders developed long-term relationships, some lasting over 20 years.

Findings: Overcoming Obstacles

Maintaining Stability Despite Changing Institutional Leadership

The Importance of Leaders who Understand Constructionism Deeply

Benefits and Limitations of Technology Workshops

Navigating Formal Schooling with Learner-Driven Projects

It was inevitable that different obstacles and challenges would surface in a project spanning well over two decades. This is no different than for any organization or educational endeavor that we know of. In fact, Constructionism itself values obstacles as an important learning experience for individuals and educational systems—deep educational change will never happen without them. Roadblocks and challenges, in this view, never "disappear": they are intrinsically present in any complex social system. What matters for Constructionists is how obstacles are dealt with, and how systems evolve as a result. One remarkable feature of the Constructionist movement in Thailand is the way it has collectively faced, worked through, and worked around obstacles, often finding creative solutions that have led to some of its greatest contributions for Constructionism globally. Below we describe four areas of obstacles that the Foundation has faced and ways they were dealt with. We continue to use these as moments for reflection in considering future iterations for the next two decades.

Maintaining Stability Despite Changing Institutional Leadership

One means of initiating Constructionism in different communities and organizations, especially in education and industry, has been recruiting leaders of various institutions and encouraging them to promote Constructionism amongst their employees. This has led to extensive training of teachers and business/industry members, with great results during the years of institutional support. At the same time if leaders do not apply Constructionism or if leadership changes, this can act as a roadblock.

As an example, we recount the following story (told to us several times) about a roadblock that eventually acted as a significant game-changer in the Foundation's direction in the early days. Many of the initial efforts to spread Constructionism followed a pattern established in the West of focusing on teacher development, with the hope that the teachers would implement it in their classrooms and spread it to students. In one massive training effort, the Foundation trained 80 teachers, two each in 40 schools. Yet, upon follow-up visits to each school, they discovered that the teachers were unable to apply Constructionism because of institutional problems beyond the teachers' control. It was in response to this finding that the Foundation shifted to work in industry, leading directly to training technicians in factories (and later employees working in areas from human resources to high levels of administration), and to developing their own flagship school, which has since become a revolutionary model of Constructionist education.

Other efforts have focused directly on getting the support of institutional leaders, for instance school principals or executive leaders in companies. Many times this has led to years of successful, even transformative Constructionist work in schools and companies. On most timescales of educational interventions (typically lasting 3-4 years), these would only be reported as successes. Indeed, we heard many reports of five or more years of successful work within an institution. At a longer timescale, however, leaders change,

and when that eventually happens the formal Constructionist efforts at their institutions tend to wane. We were thus told of teachers who could no longer apply Constructionism, or technicians who were not allowed time to proactively problem solve in a Constructionist manner. However, even when work at those institutions formally ceased, many participants told us that they continued to find other ways to implement Constructionist learning: in their families, in new workplaces, or in new educational settings. (See section on *"Deep Internalization/Personal Transformation").* This also illustrates that complex social and educational change needs time and multiple cycles of implementation. The very nature of organizations is such that changes in leadership are to be expected. Most Constructionist experiences in the West are structured as a single project spanning 3-4 years. While leadership changes might be fatal for those shorter, more limited projects, the longevity and breadth of Constructionism in Thailand allowed the overall project to continue despite them.

Reflection

On every level, institutional change is an extremely challenging endeavor. One unique contribution of the Thai Constructionist movement is its longevity, which allows us to see the ups and downs of institutional challenges that would rarely be visible on shorter timescales. At this timescale, even when not everything works out as hoped for, the persistence and creativity of Thai Constructionists is evident. Roadblocks are not terminal failures but opportunities for debugging and iteration—a true Constructionist response!

Importance of Leaders who Understand Constructionism Deeply

Two benefits of relying on core, institutional leadership are

1. their ability to apply Constructionism themselves, and to help their employees and participants learn it through practice, and
2. their broad decision-making powers that can support integration of Constructionism in an institution.

At the same time, there is a tradeoff that needs to be acknowledged: when relying on high-powered leaders, we need to be aware that while they bring coherence and agility to a project, their own lack of understanding or their sudden absence can prove very disruptive.

In our interviews we saw many examples of leaders whose deep understanding, humility, and practice of Constructionism greatly affected the people who worked with them. It is impossible to measure the contributions of several core Foundation members who:

- studied Constructionism in depth,
- intentionally pondered what a Thai Constructionism could look like, and
- through years of practice and mentorship—helped people who worked for or came into contact with them to develop their own deep understanding and practice (see sections on *"Low Ego"* and *"Long-Term Mentorship"*).

This also happened with people who were not necessarily core leaders in the Foundation, but had similar roles elsewhere. For instance, we happened to interview a teacher and a principal who had worked together for several years. They both described the same thing from different perspectives. The principal shared how she intentionally gave her teachers agency (see *"Learner Agency"* section) to decide how to integrate Constructionism in her public school, encouraging their own reflection, sharing ideas, and improving implementation year by year. Meanwhile, the teacher described how this approach helped her internalize the ideas of Constructionism through practice, trial and error, and in seeing her students' response. This example of a leader with deep understanding—who facilitated Constructionism with her teachers with integrity and a "low ego"—demonstrates one of the strengths of this type of leadership.

At the same time, other leaders who were persuaded to support Constructionism in their institutions had an insufficient understanding of what it is, what it means, and how it could be applied there. This might be because some high-level leaders have such busy schedules that they are often unable to attend many training sessions (or can only attend them partially), thereby limiting their own internalization of the concepts involved. They might also assume that offering workshops to their employees, or perhaps some time for discussion or application would be enough for Constructionism to flourish in their institution. In some cases, their employees did embody a deep understanding of Constructionism and used it to create innovations and training in their respective organizations. In other instances, however, they expressed confusion about what Constructionism was and how to apply it in their workplace. These obstacles are normal in any large-scale project with several layers of training and professional development, but Thai Constructionism has some built-in mechanisms to self-correct.

Reflection

One of the deepest strengths of the Thai Constructionist movement includes leaders who deeply understand, walk alongside, and provide space for their employees/learners to develop and practice Constructionism (see "Principles of Thai Constructionism" section). Such leaders will likely directly make a positive impact on the quality of learning and implementation of Constructionism in their institution. The opposite is also true. Institutions with leaders who do not understand and practice Constructionism may struggle more in implementing it. Finding and mentoring leaders is an ongoing challenge for any organization.

Benefits and Limitations of Technology Workshops

One of the primary ways of introducing new adepts of Constructionism in Thailand is through a series of week-long technology workshops: Microworlds, Photojournalism, LEGO®/Logo, and now GoGo Boards. The history of these workshops stem from the days when Seymour Papert and MIT professors and students visited Thailand with limited time between semesters—a few weeks at a time—and found these time-bound workshops to be a useful form of deeply immersing people in a new form of learning.

One strength of this workshop model is that it relies on core leaders who deeply understand Constructionism and have created their own workshop models that are unique and repeatable. The workshops also immerse newcomers in a situation where they have to try a different form of learning. This allows people to step away from preconceived notions of what counts as learning, and step into something new (see *"Principles of Thai Constructionism"* section). Many people spoke to us of rich, personal experiences in workshops that helped them understand new ideas of learning that included: reflection, meditation, learner agency, accepting constructive criticism, and so forth. The workshop model clearly has some positive benefits for quick, deep immersion.

However, there is another side to workshops, not just in Thailand, but in Classic Constructionist communities around the world as well. Deep learning in a workshop focused on a particular educational technology does not translate directly to other areas of one's life. This is hardly a concern when most of the international applications of Constructionism only tackle implementing technology in formal or informal educational settings. For them, the end goal is often for students to master a new technology skill, such as coding. Yet, in Thailand there are far deeper objectives of transforming people's lives, communities, and businesses—not just education. Thus, it is important to note that many workshop attendees did not understand how to apply the newly encountered form of learning to other areas of their lives. Others expressed confusion over how to apply Constructionism outside of digital technology. This represents one of the classic, historical challenges in education—*transfer*—a struggle of innumerable educators worldwide. In other words, classroom learning (even a Constructionist technology workshop) rarely translates easily into everyday life, and most people experience frustration with this gap.

However, this presents an opportunity to consider how so many people in the Thai Constructionist community have managed to develop a deep understanding of Constructionism to the point of applying it in workplaces, schools, and everyday life.

Reflection

The technology workshops that introduced most Thais to Constructionism have their benefits, but, as would be expected in any workshop situation, they leave participants questioning how to apply Constructionism "in the real world". This may be an area for further innovation in the Thai Constructionist community, especially in light of practices that have helped people develop lifelong learner trajectories in Constructionism.

Navigating Formal Schooling with Learner-Driven Projects

One tension that emerged in interviews was between supporting learners in following their interests through personal projects, and helping them develop deep, critical knowledge within specific disciplines. This was particularly evident amongst school teachers, both in public schools and at the flagship DSIL. On the one hand, teachers wanted to support learners' interests through projects, but on the other—either because of their awareness of students' needs for deep content knowledge, or because of bureaucratic requirements (e.g., secondary school or even college-entrance requirements)—teachers felt a need to support certain content knowledge and struggled with how to do that in Constructionist ways. Teachers often leaned toward either more pragmatic or idealistic ideas about how to apply Constructionism.

The solutions found by teachers (in their classrooms) and schools (as organizations) are inspiring. Some public school teachers devised different ways to bring in elements of Constructionism through various content-related projects, or through timeslots set aside over the span of a few weeks. One public school slowly spread innovation-inspired projects one grade at a time. DSIL has perhaps the most interesting trajectory, as it began with almost entirely project-based and interest-driven curricula created by each teacher. Over the years, the school has come up with other solutions to educational tensions. One solution is through specialized tracks. At the secondary level, it provides two days a week of project-focused tracks in science, multimedia, and engineering. Another solution was for each teacher to try to integrate students' interests at different levels. In other words, not all activities are "purely" interest-driven, but might be interest-driven within specific content-driven constraints.

Here again is a case where facing obstacles has promoted diverse, innovative solutions. This is also an area of tension that has the most in common with other Constructionist communities around the world, who also face challenges in applying it in different disciplinary areas or in the integration of makerspaces, computer labs, and similar innovative spaces within K-16 schools. The Thai solutions to those challenges have been quite original and possibly an inspiration to other Thai schools, as well as similar schools in other countries.

Reflection

Worldwide there is a tension within and between Constructionist practitioners on how to support learner-centered, interest-driven projects, while at the same time supporting the development of deep, content knowledge that will equip learners to pursue interests long term in different fields. There is no single solution to this tension. It may help to simply recognize its continued existence while trying out, reflecting on, and iterating on different educational efforts. It is also important to support teachers at every stage of their development (whether tentative, enthusiastic, novice, or experienced) and in every type of setting (i.e., schools with differing constraints and various forms of support for Constructionist education).

Conclusions

Relevance of Thai Constructionism to International Communities

Uniqueness of Thai Constructionism Movement

Relevance of Thai Constructionism to International Communities

Constructionism is one of the most influential educational philosophies worldwide. It is the force behind the Logo programming language, LEGO® robotics kits, the Scratch programming platform, and the Maker education revolution, as well as a significant part of the educational technologies used all around the world today. It has spread to all five continents and influenced thousands of educators worldwide. However, Seymour Papert and his collaborators were originally not just interested in the applications of new technologies in schools, but in much deeper changes in how people learn and live. In fact, Papert believed that the impact of Constructionist learning would extend far beyond schools and into our daily lives. This is because even though Constructionism is often associated with computer programming and robotics, it is essentially a theory about how learner agency, student empowerment, and rich learning tools and environments can fundamentally alter our relationship with learning in our personal, cognitive, and professional lives.

Similar to Dewey, Freire, Piaget, Vygotsky, and other progressive educators, Papert was not trying to optimize the artificial system of schooling, but instead to redesign the system based on research into how people learn. In his vision, learning becomes natural, instead of forced, seamlessly integrated into our lives, instead of segregated, and aligned with our personal and career goals, rather than decontextualized.

However, to our knowledge, nowhere else in the world have the principles of Constructionism been applied for so long, in such a wide range of institutions, and with such intentionality and persistence. Granted, there are countries in which thousands of schools might have access to robotics or computer programming, and there might be school systems with hundreds of makerspaces. There are also some isolated experiences with Constructionism in the workplace and in villages or underserved neighborhoods, but these were isolated, rather than part of a larger effort coordinated across an entire country. In addition, most other Constructionist experiences around the world were either very limited in time (2-4 years), constrained to K-12 education, or spontaneously adopted without central planning. Some of these international projects had a community development component, in which children designed solutions for their community. However, rarely, if ever, were those solutions actually implemented in the community: as a rule, they remained school projects and never made it out into the real world. Even experiences that were initially led by MIT and Papert did not survive after the team returned to the US. In fact, there is a long list of abandoned Constructionist projects all around the world that were interrupted or faded away after a few years of intense action and excitement. That was not the case in Thailand, making it a unique example in the world.

Uniqueness of Thai Constructionism Movement

As discussed before, Papert advocated that the implementation of Constructionism and of a computer culture in Thailand should not be about "transfer of computer technology" from the US to Thailand, but about "growing a new, specifically Thai, computer culture."

This statement was revolutionary for several reasons. It was customary for U.S. universities, foundations, and international organizations to fix problems in the developing world by deploying large teams of consultants and technicians from the US or Europe. These teams would bring solutions developed in their offices in New York, London or Paris to different countries and enforce an exact implementation, with as little deviation from the original instructions as possible. The assumption was that developing countries could not contribute to these solutions, and that the local populations should have no voice in addressing their problems. Further, Seymour Papert and his team were coming from MIT, one of the world's most renowned universities, so it could be expected that his ideas would have even more weight, and that the philosophical distance between his team and local teams in Thailand would be impossibly large.

Yet in Thailand, a new, specifically Thai Constructionism culture has developed as a result of both the initial design proposed by Papert and his team, and the principles and actions adopted by the Thai team and discussed in our findings. In other words, the project took a very different, productive route from that seen in many other countries.

In Thailand, there was a unique combination of external ideas from MIT combined with local expertise and knowledge. The ideas not only merged, they co-evolved: at some point in the project, "MIT Constructionism" gave place to "Thai Constructionism," not as a derivation of the former, but as a new and equivalent version. Our analysis shows that Thai project participants explicitly complemented their version of Constructionism with spirituality, years-long mentorship, and implementation across one's life—elements that had never been part of the original MIT version, but that have value to Constructionism around the world.

Thus, Papert's warning that "mindless transfer of technologies does run the risk of undermining cultures" was a present and real danger, but the creative project design in Thailand not only avoided that mistake, but went above and beyond, creating an entire new version of the culture. Thus, fortunately, even though the project was connected to MIT only during 1996-2001, it has continued for more than 20 years.

Our research showed that some of the benefits of Constructionism appear only after many years. At an institutional level, the Foundation has met many roadblocks. At smaller timescales, these

may have appeared to be terminal failures: schools with trained teachers who did not or could not apply Constructionism, schools or businesses where leadership change led to the discontinuation of overt Constructionism work. But long-term persistence showed that many discontinuations were in fact course corrections.

One of the reasons why Thai Constructionism has continued for over 25 years and will, we believe, continue long into the future is because of the deep learning that has resulted in personal transformation. This deep learning has happened because of the integrity of Facilitators *over decades* in supporting their students' interests, having "Low Egos", and providing just-in-time support as students learn, make mistakes, reflect, and persevere.

Thai Constructionism could have a considerable impact within the international Constructionist community. Many of the principles, design challenges, and lessons learned of Thai Constructionism could be shared around the world to inspire leaders, teachers, and business people etc. In most countries, community development projects are rarely combined with educational projects, business leaders almost never consider changing their corporate culture to include Constructionism, and many of the solutions imported fail to be properly integrated into the local culture. Thailand could lead the way to a real transformation in how the world merges community and personal development, education, technologies, and powerful ideas.

Appendix: Research Methods for Data Collection and Analysis

Research Visits and Participants

Language and Translation

Data Collection, Reflection, and Multiple Research Cycles

Documents

Overall Data Collected

Analysis

Research Visits and Participants

The complexity of the project required a comprehensive multi-phased data collection operation, organized into four research visits. The first took place in December 2017, and comprised interviews with 23 initial participants. During each visit thereafter we strategically interviewed new participants and followed up with additional questions for prior participants in order to build a more comprehensive picture of the Constructionism movement in Thailand (see Table 1). Our visits were limited by time and place, and consisted of trips to Bangkok and three other areas of the country to meet participants where they lived and worked. Where possible, we timed our visits to coincide with events in the Constructionism community that allowed us to meet with people already gathering in a single time and place. *Note that all names of participants were changed for anonymity, and that we have followed all Institutional Review Board procedures for subject confidentiality and anonymity.*

Table 1. People interviewed across research visits.

Numbers are shown as New *[+Follow-up]*. In other words, in June 2018, we interviewed 30 new participants and followed up with 5 *prior* participants: 30 *[5]*.

Area of Concentration	December 2017	June 2018	August 2019	January 2020	Total People	Total Hours
Central Foundation Leadership	5	3 *[3]*	--	1 *[2]*	9	34.75 hours
Industry	6	6 *[2]*	--	--	12	16.25 hours
Villages	4	12	1 *[5]*	5 *[4]*	23	39.75 hours
Education	8	9	--	*[1]*	17	17 hours
Total	**23**	**30 *[5]***	**1 *[5]***	**6 *[7]***	**61 people (16 more than once)**	**107.75 hours**

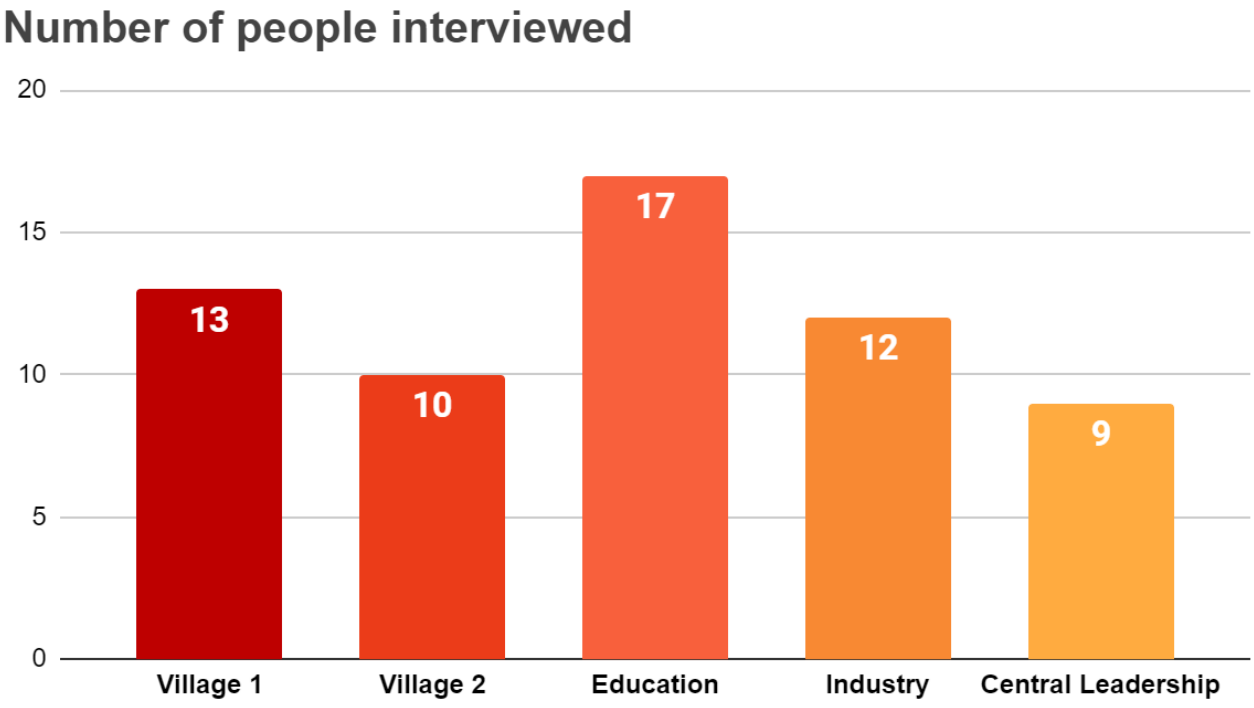


Figure 1. Number of people interviewed (N=61).

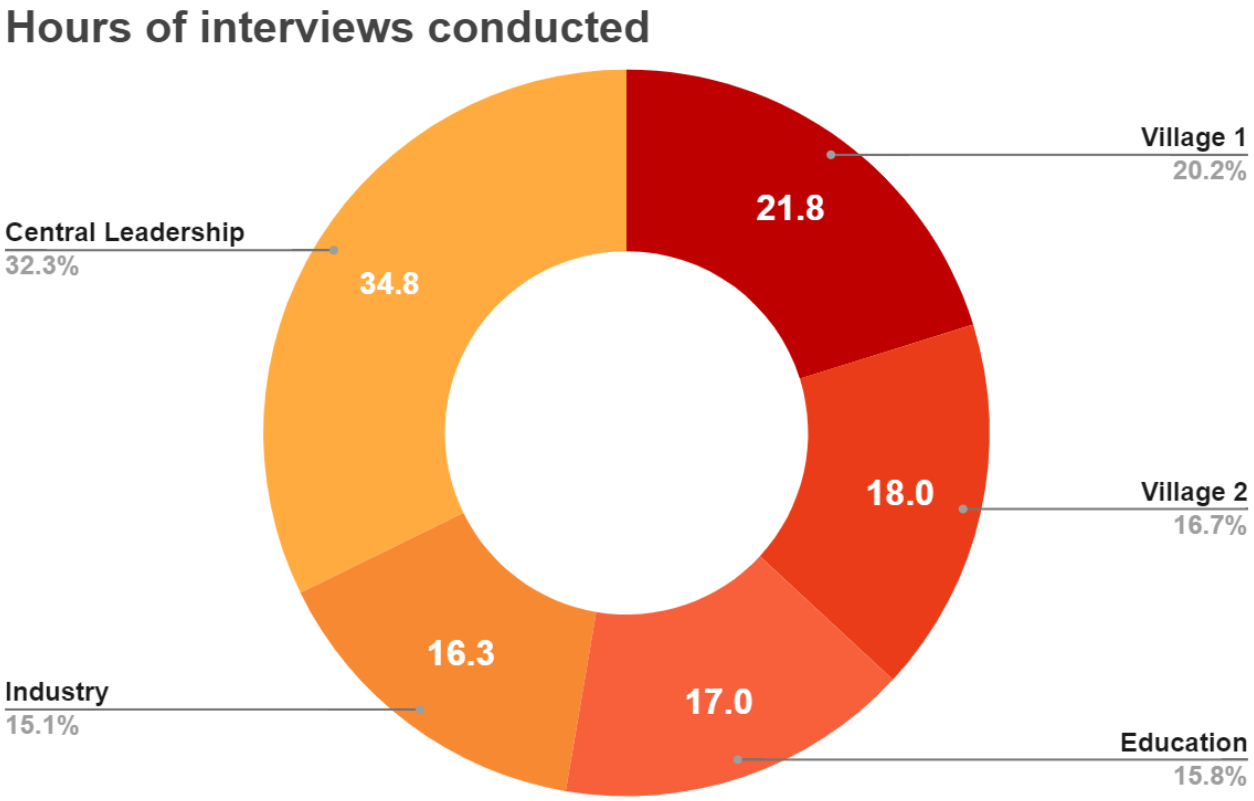


Figure 2. Hours of interviews and percentage (107.75 hours total).

Language and Translation

Most interviews were conducted in Thai and others in English, according to the interviewee's preference. We had a Thai speaker present in every interview except in a few cases where the participants were completely fluent in English. This allowed the interviewees who were less comfortable with English to switch between languages if they desired. All interviews in Thai were professionally transcribed and translated to English. Interviews done in English were professionally transcribed.

Data Collection, Reflection, and Multiple Research Cycles

Following best research practice, after each data collection phase, the research team discussed preliminary findings in order to decide on the next round of interviews. These discussions also involved soliciting the advice of core Foundation team members on interviewing priorities, especially since the Foundation's work continued to grow and expand between research visits. As a result, new questions were added to the interview protocols, and interviewees joined the pool each round. Further, additional interviews with 16 individuals helped us "member check" our understandings and findings with participants, fill in holes in our understanding, and obtain direct feedback on drafts of timelines and specific key historical events.

Documents

- Another data source were project documents, starting as early as 1996. These included:
- Original letters and proposal documents from the beginning of the Lighthouse Project in 1996-1997
- Project reports from the Foundation to the Office of the National Education Commission from 1999, 2000, 2003, and 2006
- A book written by one village (translated into English)
- Engineering plans and technical documents for water management in villages
- Charts, diagrams, spreadsheets, and slides regarding different projects in businesses, villages, and schools
- Hundreds of photographs of projects and sites in villages and in non-formal computer labs
- Nearly 50 pages of written reflections and an historical account by one key Foundation leader
- Prior publications (in English) by the Foundation team (Israsena, Tutiyaphuengprasert, & Sipitakiat, 2012; Israsena, et al, 2014).

Overall Data Collected

After four phases of data collection, we had accumulated more than 107 hours of interviews with 61 people (16 people more than once) and over 350 pages of scanned project documentation and written reflections by participants. Considering the typical projects described in the international research community of Constructionism, Learning Sciences, Rural Education, and ICT4D (Information and Communication Technologies for Development), to the best of our knowledge, this is one of the largest and most comprehensive datasets in the field.

Analysis

The data analysis followed the guidelines of rigorous, qualitative research. In particular, we used the case study framework by Merriam (1998), where the primary case is the Foundation's work since 1997. This work also includes several more specific cases, including Constructionist work in two villages, the DSIL school (and formal education more broadly), and corporations. These sub-cases overlap, with some people and events that were important in multiple areas. As Merriam states, data analysis is "the process of making sense out of the data... [which] involves consolidating, reducing, and interpreting what people have said and what the researcher has seen and read – it is the process of making meaning" (p. 178). We have approached this analysis process in several ways that complemented one another and gave us a fuller perspective on the large amount of data collected, including ethnographic analysis, narrative analysis, constant comparative method, content analysis, and analytic induction.

We first approached the data by looking for themes across participants throughout the entire set of interviews, i.e., conducting constant comparative analysis. This is the primary analytical technique that led us to write the *"Principles of Thai Constructionism"* section. This methodology allowed us to identify overarching themes in people's beliefs and experiences of Constructionism. Comparing these themes with classic Constructionist texts (e.g., Papert, 1996, 2000) helped us to pinpoint distinct contributions from a Thai Constructionist perspective. Our initial findings from the first set of interviews conducted in December 2017 was published (Fields & Blikstein, 2018), and our comparative analysis expanded to encompass all of the interviews.

However, we needed additional analytical techniques to understand the historic trajectory of the Foundation as a whole, as well as the development within and between communities and people in the broader Foundation. To this end, we performed narrative, content, and ethnographic analysis concerning both communities (i.e., villages, schools, businesses) and individuals whose life trajectories had made a significant impact in one or more of those communities. This helped us to weave together the different historical, cultural, geographic, and personal influences on how understanding and practice of Constructionism unfolded in and through all

these different times, places, and people[2]. While doing this, we developed a few methodological innovations. For instance, we produced an extensive timeline of the Constructionist work in one village, using post-it notes on large pieces of paper laid out over an area four meters long. We met with a focus group of villagers who corrected, debated, and filled in areas to make the timeline more robust. Given the long duration of the project, the "timeline conversation" was an apt way to both elicit rich dialogue with our interviewees and refine our knowledge of the sequence of events in the project. The collaborative creation of the timeline is also an example of how we developed "external validity" in this study.

Reliability and external validity are core areas of qualitative research. To ensure reliability in this study, we have tried to explain and be aware of our own positions, i.e., the innate limitations we have as outsiders to both Thailand and the Foundation's work. Being an outsider—from different countries, careers, and personal backgrounds—has advantages of giving us new perspectives on the work, but it also comes with limitations. Being aware of these throughout data collection, analysis, and writing helps provide reliability. For external validity we have engaged in "member checking", both in the example of the collaborative timeline above, with second (and sometimes third and fourth) interviews to check our understanding with that of participants, and through regular meetings with two established members of the Foundation who would make sure that we are "getting it right". Our periodic meetings with the Thai Foundation team focused on presenting initial hypotheses, brainstorming possible connections and causal chains, identifying gaps in the narrative, refining the interview protocols and lists of interviewees, and making informed decisions about next steps. All of these measures safeguard the rigor of this study.

[2] *At the time of this writing (Fall 2020), the analysis of sub-cases is deep and ongoing, with the plan to support the writing of a book where each chapter can delve more deeply into some of the "sub-cases" within the Foundation's history.*

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