# Analyzing Students' After-School Artifact Creation Processes in a Mobile-Assisted Language Learning Environment

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**Abstract**: This paper presents "Move, Idioms!", a Mobile-Assisted Language Learning design that emphasizes learners' habit of mind and skills in making meaning with their daily encounters, and associating those with the knowledge learned at the formal classes. The students used smartphones on a 1:1, 24x7 basis to take photos in real-life contexts related to Chinese idioms, made sentences with the idioms, and posted them onto a wiki space for peer reviews. In this paper, we focus on investigating students' cognitive processes and patterns in artifact creation. Through two case studies, we gained better understanding of how (1) physical settings in the informal contexts, (2) parental support, and (3) technology facilitated students' meaning making in their daily life. We hope to contribute to the literature of mobile learning by exploring virtually limitless learning opportunities that informal contexts and parental involvement may offer to learners.

**Keywords**: Mobile Assisted Language Learning (MALL); Seamless Learning; Learning Ecology; Parental Support; Learner Content Creation

## 1.   Introduction

How can learners' habit of mind and skills in making meaning with their daily encounters, and associating those with their formal learning be nurtured through (teacher-)*facilitated seamless learning (FSL)* [1] experiences? This is one of the major research issues of our school-based study in exploring a FSL design for Mobile-Assisted Language Learning (MALL), "Move, Idioms!" [2][3]. Seamless learning, the overarching framework of our study, is defined by Chan et al. [4] as an approach that a student can learn whenever and wherever she is eager to learn, and can easily switch from one context to another (formal and informal learning, personal and social learning, physical and cyber-space, etc.), assisted by the personal device.

In the study, we facilitated a Primary 5 (11-year-old) class in Singapore to study 48 Chinese idioms (and 8 additional conjunctions) over 10 months. Apart from on-campus idiom/conjunction lessons in small-group contextualized learning activities, the students were each assigned a smartphone for 24/7 access. With their smartphones, they associated their encounters or created contexts in their daily life with the idioms/conjunctions learned, took photos and made sentences with the idioms/conjunctions (i.e., photo-blogging-like activities), and then posted them onto a wiki space for peer review.

In this paper, we focus on analyzing students' artifact creation activities in out-of-school settings, mediated by the mobile devices. We consider these learning experiences as different forms of personal or social meaning making that involves certain patterns of cognitive processes. Through interpreting their daily encounters or creating contexts, alone or with other people's participations, the students articulated their renewed or even creative understanding of such authentic contexts – they did so by associating them with the vocabularies (idioms and conjunctions are special forms of vocabularies) that they learned in formal lessons. In particular, we investigated the roles of (1) physical settings, (2) parents, and (3) mobile technology, in supporting students' out-of-school artefact creation activities through two case studies.

## 2. Literature Review

A child's learning experience is not just what happens inside the school. Few can deny that external factors such as experiences in the informal learning environments (e.g., [5]) and parental involvement (e.g., [6]) have an impact on school success [7]. Parental involvement in children's learning may come in different forms, such as being active observers or monitors of their children's home learning with the aid of mobile technologies, or communicating with the teachers to share their observations in the children's learning [8]. Current technological advancements have provided more opportunities for parents to actively experience what and how their children learn, in addition to checking the results of their work.

Indeed, being the closest people to most of the K-12 students and potentially powerful in complementing the latters' school-based formal learning, parents are natural resources in the seamless learning experience of the children. However, according to [9]'s critical analysis in the literature on mobile seamless learning published between 2006 and March 2011, the aspect of parental involvement had been underexplored (though part of the reason is that some literature is pertaining to higher or adult education, where parental involvement was irrelevant).

Apart from parental support, another crucial factor that shapes learners' experiences in informal learning contexts is the ecological environments where they are situated in. Barron [10] defines a learning ecology as "the set of contexts found in physical or virtual spaces that provides opportunities for learning" (p.195). Luckin [11] advocates the establishment of individual learners' cross-context and perpetual learning ecology that is genuinely learner centric. Such views are congruent with our recent exposition (see: [12]) that learners ought to gradually assume greater agency in deciding what and how to learn, and being able to self-identify and appropriate learning resources across different spaces to mediate their learning, rather than being restrained by the designed learning resources for prescribed tasks.

## 3. Study Description

Vocabulary learning is often delivered in conventional ways, such as providing abstract definitions and sentences stripped off the context of use [13]. Such pedagogical strategies may pose a problem for acquiring context-dependent vocabularies, such as idioms [14]. Recognizing both the importance and the limitation of formal, in-class language learning, theorists in this field have been advocating the integrations of formal and informal [15] language learning, which mesh well with the notion of seamless learning. Informed by the theories, we developed a cyclic, customizable learning experience design of "Move, Idioms!" consisting of 4 activities:

**Activity 1 – In-class/on-campus contextual idiom learning**: During each lesson, the teacher conducts contextualized learning activities such as facilitating the students to take photos on campus to illustrate the idioms. This is to motivate and prepare students for carrying out the subsequent activity on their own. Strategies of artifact creation are introduced by the teacher, such as idioms should be used in suitable contexts, e.g., the idiom 手舞足蹈 in the sentence "我在手舞足蹈" (I am dancing for joy.) is undesirable since it is decontextualized use, i.e., the sentence created lacks contextual information to demonstrate understanding.

**Activity 2 – Out-of-class, contextual, independent sentence making**: This is the main focus of the paper. Students carry the smartphones 24/7 to use contexts in their daily lives which can be associated with the idioms. They then take photos, make sentences using the idioms to describe the photos, and post them onto a wiki space. A wiki page for each idiom is created for students to post and compare their artifacts.

**Activity 3 – Out-of-class, online collaborative learning**: Students perform peer reviews on the wiki by commenting, correcting or revising their peers' sentences.

**Activity 4 – In-class consolidation, collaborative learning**: Each group is assigned to study a few existing artifacts consisting of correct, ambiguous and erroneous usages of an idiom.

The groups compare the artifacts and revise the sentences where necessary. Subsequently, classroom discussion helps clarify contradictory views.

We implemented two cycles of "Move, Idioms!". The first cycle was a pilot study taking place during July-September 2009 involving a Primary 5 (11-year-old) class. In the study, we learned through student interviews that student and parent co-constructed some artifacts with positive outcomes (judging by the quality of such artifacts). The second cycle, the focus of this paper, took place in January-November 2010 and involved another class of 34 Primary 5 students, with mixed abilities in Chinese. Each of them was assigned a Samsung Omnia II smartphone with a built-in camera, Wi-Fi access, Internet browser and English/Chinese text input. We co-designed with teachers eight "Activity 1" and two "Activity 4" lessons which were then enacted by the Chinese teacher of the class with 2-4 week intervals. Meanwhile, students carried out "Activity 2" and "Activity 3" continuously at their own pace. We developed a simple application on their phones for their convenience of taking/assembling photos and making sentences/paragraphs in one user interface, and posting them onto the wiki page of their choice.

Recognizing our seamless learning design as an opportunity to better involve parents in advancing student learning during Activity 2, we organized a "meet-the-parents" session prior to the second cycle. In the session, we briefed the parents of the participating students about the benefits and challenges of mobile seamless learning, and suggested to them how to regulate or participate in the students' use of their smartphones after school. A mother-daughter dyad from the first cycle shared their fond experiences of co-creating artifacts. Some parents who attended the session found it inspiring and were willing to give it a try.

Due to the cross-context nature of seamless learning, we employed a variety of data collection and analysis methods. Apart from pre- and post-tests to assess students' learning gains in idiom-context associations, two post-questionnaires were administered. Questionnaire 1 was for the students to report facts and perceptions of their learning experiences across various contexts, including the informal settings. Furthermore, to collect data on the students' artifact creation processes in informal settings, we periodically compiled the artifacts that individual students created for Questionnaire 2, in which we asked the students to report their processes in creating each artifact. In this paper, we will focus our analysis on students' Activity 2 tasks.

Student responses were coded based on our classification of "three types of cognitive processes in artifact creation" as our findings in the first cycle (see: [3] ), namely, Type 1: with an idiom in mind → object finding/manipulation or scenario enactment → photo taking; Type 2: Object/human/scenario encountering → associating it with an idiom (immediate association) → photo taking; and Type 3: Object encountering/manipulation or scenario encountering/ enactment → photo taking → associating it with an idiom (delayed association). Our earlier analysis of the three types of processes as reported in [3] suggests that each of these processes would correspond to a vocabulary learning strategy. We consider Type 1 the easiest, perhaps an assignment-minded process could serve as an entry-level activity for newcomers to such activities; Type 2 the highest level process as such immediate retrieval of the relevant idioms required the students' internalization of their acquired idioms. Type 3 could serve as a bridging strategy between the first two. Descriptive statistics were analysed to help us understand the trends, which will be reported in the subsequent section.

In our analysis, we distinguished the *real-life context* and the *artifact context*. The real-life context is the actual physical context that facilitates student's artifact creation; the artifact context is the context that is portrayed by a student artifact (through the sentence) and reflects the student's meaning making of the real-life context. The two contexts may or may not be consistent. For example, a student takes a photo of a doll lying on the sofa (the real-life context) and composes a sentence, "Exhausted, the girl fell asleep on the sofa." (the artifact context).

Furthermore, by referring to students' responses to the questionnaire, we identified several students who went through complex artifact creation processes and generated quality artifacts. We conducted one-to-one interviews with them and their parents to find out the processes of

creating individual artifacts and the sources of inspirations in greater details. In sections 5 and 6, we present artifact creation processes using two student cases, Colin and Jane (pseudonyms).

## 4. Findings: Descriptive Statistics of Students' Artifact Creations

Throughout the study, the students generated 853 sets of artifacts. We performed descriptive statistical analyses on students' artifact creations to investigate relevant patterns. Due to the space limit, we will only present the analysis in Table 1 that is most relevant to our focus here.

Table 1: Cross tab of settings where artifacts were created vs. cognitive process types (whole class)

| Settings where artifacts were created | Type 1 | Type 2 | Type 3 | Not sure | Total |
|---|---|---|---|---|---|
| Within the school | 75 | 42 | 28 | 8 | 153 |
| At individual students' home | 193 | 134 | 44 | 5 | 376 |
| Other locations | 37 | 114 | 164 | 13 | 324 |
| Total | 305 | 286 | 236 | 26 | 853 |

Table 1 was generated from Questionnaire 2. There were 26 artifacts where the students could not recall the cognitive processes, and were therefore categorized under "not sure". We distinguished the physical settings where the artifacts were created into three categories – within the school, at students' home, and at other locations (out of home and not in the school). The last two settings are considered the contexts where students created artifacts spontaneously or by self-initiation. As stated above, we are in favor of Type 2 artifacts since it is an indication of students' internalization of the acquired vocabularies, followed by Type 3 artifacts.

The statistics in Table 1 indicates that the students created the greatest amount of Type 2 and Type 3 artifacts at "other locations". Through the student interviews, we found out that as the real-life contexts of "other locations" such as their neighborhoods, shopping malls, destinations of family outings and so on, were places less accessible to them, and where they usually did not stay long. Hence, they tended to apply Type 2 or Type 3 cognitive processes in creating artifacts in an opportunistic and "hit-and-run" manner. In contrast, when they were in the school or at home – two familiar locations where they most likely had the access to the physical resources available – they tended to apply Type 1 process as they could decide on target idioms in advance and take time to identify or create contexts for artifact creations.

With this, we argue that carrying out artifact creation activities at "other locations" is a natural strategy to boost the amounts of Type 2 and Type 3 artifacts. Nevertheless, according to the findings of Questionnaire 1, parents of 11 out of the 34 target students forbad their children from bringing the phones out of home other than the school due to the fear of loss or damage. This had limited students' opportunities in creating more artifacts for greater learning gains.

## 5. Case Study 1: Colin's Experiences of Artifact Creations in Informal Setting

Colin came from an English speaking family. Prior to our study, he was an academically low ability student in Chinese Language and did not like the language. His parents checked with him about "Move, Idioms!" only once at the early stage of our study. They then let him carried out the learning activities on his own. Colin was not keen on involving parents in creating artifacts, other than occasionally asking them to take photos of him.

Despite that, Colin extended his creativity to overcome the limitations of working alone. Apart from taking photos of objects in their natural settings, he was good at improvising artifact contexts at home with the physical resources available. For example, he often arranged the same set of toys into different story contexts and made sentences that utilized multiple idioms.

Figure 1 features two artifacts created by him. The idioms are underlined in the sentences. In Figure 1a, the photo of Colin on the left was taken 5 years ago with a camera when the family

visited the USA. His cognitive process in creating this artifact was:- **(1)** He casually browsed the digital photo album of the tour, encountered this photo and associated it with the idiom 闷闷不乐 (depressed). *[Cognitive process Type 2]* **(2)** Having told by the teacher that he needed to provide his artifact a context, he imagined that his mother gave him something to cheer him up afterwards. He used a variety of stationery on his table as the props to take a new photo. He associated that with the idiom 各种各样 (a variety of). *[Type 2]* **(3)** He combined the two photos and wrote the first sentence. He then extended the story to incorporate two more idioms: 手舞足蹈 (dance with joy) and 兴高采烈 (with great delight), and wrote the second sentence. *[Type 3]*



(1a) 妈妈见我闷闷不乐，买了各种各样的文具给我。我开心得手舞足蹈，兴高采烈地向前对妈妈道谢。
(Translation) Seeing me <u>depressed</u>, mum bought me <u>a variety of</u> stationery. I <u>danced for joy</u> and thank mum <u>with great delight</u>. (20 May, 2010)

(1b) 爸爸一直指手画脚，一下子要我做功课，一下子要我去吃饭，一下子要我去睡觉，真烦！
(Translation) Dad keeps <u>pointing his finger</u>, first wanting me to do my homework, then instructing me to have meal, and then demanding me to go to bed. So annoying! (7 April, 2010)

Figure 1. Two artifacts created by Colin (pseudonym)

The process of creating the artifact in Figure 1b was more straightforward. The artifact was inspired by his father's usual "habit" in regulating Colin's daily life. His father did not mind "playing himself" in the picture-taking and neither raised any issue after reading the sentences.

Table 2 presents the overall statistics of Colin's artifacts. From the table, we observe that although he was allowed to bring his phone and take photos at "other locations", he generated more artifacts at home, most of which were Type 2 artifacts. The number of his Type 2 artifacts (110) had exceeded the sum of his Type 1 and Type 3 artifacts (61+39=100).

As a student who used to dislike Chinese, it was amazing that he had been so motivated to create such a huge amount of artifacts. He scored 43 out of the full score of 50 in the post-test that we administered (class mean: 42.7), as compared to 32 in the pre-test (class mean: 35.7).

Table 2: Cross tab of settings where artifacts were created vs. cognitive process types (Colin)

| Settings where artifacts were created | Type 1 | Type 2 | Type 3 | Not sure | Total |
|---|---|---|---|---|---|
| Within the school | 10 | 5 | 0 | 9 | 24 |
| At home | 44 | 65 | 10 | 3 | 122 |
| Other locations | 7 | 40 | 29 | 6 | 82 |
| Total | 61 | 110 | 39 | 18 | 228 |

## 6. Case Study 2: Jane's Experiences of Artifact Creations in Informal Settings

Jane came from a predominantly Mandarin-speaking family. She was an academically high ability student in Chinese Language in her class but slightly above average in the entire Primary 5 level in the school. However, she found herself more fluent in English and preferred to use the language. Unlike Colin, Jane's mother who attended the meet-the-parents session responded to our call for working with her child in artifact co-creations. In many cases, it was the mother who proactively gave her daughter opportunistic ideas.

With her mother's full support, Jane was very motivated in carrying out Activity 2 and took pride in the artifacts that she created alone or with her mother. Figure 2 illustrates three examples of Jane's artifacts. Figure 2a and 2b were inspired by the same real-life context – a girl carrying an umbrella. However, she created two different artifact contexts out of it.

Her cognitive process in creating these artifacts was: **(1)** Her mother picked her up after school. On their way home, she thought she could make a sentence pertaining to her 五颜六色

(colorful) umbrella; she passed her mother her phone to take a photo of her back, carrying the umbrella. *[Type 2]* **(2)** She checked the photo on her smartphone, and associated it with two other potential idioms: 闷闷不乐 (depressed) and 一言不发 (speechless). *[Type 3]* **(3)** She decided to make another sentence by improvising a different context to explain why she looked depressed and speechless in the photo. She noticed the sign (see the first two photos from the left in Figure 2(b)) mounted against the wall at the void deck of a residential apartment near them. She came up with the idea of not being able to play with her friends due to the prohibitions. **(4)** They carried on their way home. Her mother advised her to take another photo to further depict that "she left the place speechless". She took a photo of the empty corridor right outside their apartment (a different apartment block from where they took the photos of the sign) for that purpose. **(5)** Upon returning home, she made the sentence in Figure 2(a). She then ordered the four photos taken for the second context and made the sentences in Figure 2(b).

| (3a) 我有一把五颜六色的雨伞。<br>(Translation) I have a colorful umbrella. (July 20, 2010) | (3b) 本来想和朋友在这里玩耍可是，当我看到这些预告时，我闷闷不乐，一言不发地走开。这里不能踢球，随手丢垃圾，流滑板和停脚踏车。<br>(Translation) I wanted to play with my friends here. However, when I saw the sign, I was depressed and walked away speechless. Soccer game, littering, skating and cycling are prohibited here. (July 20, 2010) |

Figure 2. Two artifacts created by Jane (pseudonym)

Table 3 shows the overall statistics of Jane's artifacts. She was engaged in more outdoor activities than Colin as the number of artifacts that she created at other locations (157) doubles those she created at the school and at home (12+62=74). We tracked her monthly posting statistics and discovered that her artifact creation activities in informal settings had been shifting from predominantly Type 1 to predominantly Type 3 (plus a healthy amount of Type 2 artifacts created at other locations). This is because she had gradually venturing into creating more complex artifacts − i.e., taking a set of photos with a coherent artifact context, and then sitting down, taking her time to compose and extend a paragraph that utilized multiple idioms. This shows the positive impact of parental support in such informal learning activities.

Jane scored 49 out of 50 in the post-test (class mean: 42.7) as compared to 35.0 in the pre-test (class mean: 35.7).

Table 3: Cross tab of settings where artifacts were created vs. cognitive process types (Jane)

| Settings where artifacts were created | Type 1 | Type 2 | Type 3 | Not sure | Total |
|---|---|---|---|---|---|
| Within the school | 5 | 3 | 4 | 0 | 12 |
| At home | 47 | 5 | 10 | 0 | 62 |
| Other locations | 11 | 30 | 116 | 0 | 157 |
| Total | 63 | 38 | 130 | 0 | 231 |

## 7. Discussion

Looi, Wong and Song [16] foreground two main characteristics of mobile learning, namely, (a) mobility: learning no longer happens in a fixed physical place, but occurs in environments that moves with the learners; (b) personalization: learning is more personalized in continually reconstructed contexts. The new focus is laid on learner generated contexts [11] that could occur in any physical or virtual space, with individual learners having greater control over what and how they learn [17][18]. In the context of our study, what we have strived to achieve is to facilitate the students in enacting holistic learning experiences that are rooted in such notions, with the exploitation of both the mobile affordances of mobility and personalization. Beyond the

classroom lesson design and enactment and the analysis of the student artifacts, we are now focusing on finding out various processes of the students' artefact creation activities in informal (out-of-school) settings and their implications.

Building on our findings in the pilot study, we further investigated the characteristics of the three types of cognitive processes in artifact creation, which are summarized as below,

- **Type 1**: Assignment-like artifact creation process with prescribed artifact contexts to identify; appropriate for form-meaning connection in vocabulary learning; mostly taking place in the school or at home;
- **Type 2**: Immediate, opportunistic , spontaneous association; conducive to context-meaning connection in vocabulary learning; mostly taking place at home or "other locations";
- **Type 3**: Spontaneous photo taking and delayed association; suitable for context-meaning connection in vocabulary learning and extension of the artifact context; mostly taking place at 'other locations'.

Although we favor Type 2 artifacts, we do not discriminate two other types of artifacts. Type 2 and, to a lesser extent, Type 3 artifacts may indicate the authors' (already) internalization of individual idioms. However, creating Type 1 artifacts may serve as a strategy for the students' deep learning of individual idioms to achieve internalization. We are concerned about how to encourage those students who mostly stick to creating Type 1 artifacts to create more Types 2 and 3 artifacts for a more balanced language development.

As stated before, we observed that visiting "other locations" is a natural strategy to boost Types 2 and 3 artifacts. However, we need to respect some parents' stance of forbidding their children from bringing the phones out of home. An alternative strategy is to enact more classroom activities that aim at building up Type 2 skills among the students. Examples are flashing context-rich photos and inviting students to brainstorm relevant idioms, and facilitating small-group artifact co-creation activities for generation of Type 2 artifacts. Students will then be encouraged to transfer the skills to their personal artifact creation activities at home.

We have also foregrounded the value of parental involvements in their children's mobilized and personalized learning in informal settings. In our study, the parents' roles went beyond monitoring learning progresses or pushing for drill and practice. They motivated and supported their children's learning, which were interwoven into their family life. The discourses between Jane and her mother exemplify how family-based collaborative learning may inspire children to push their boundary in carrying out learning tasks.

Conversely, even without substantial involvement of his parents, Colin turned his home into his personal 'learning playground' where he could appropriate suitable physical or digital resources to mediate his artifact creation. With Luckin's [11] notion of "learner generated contexts" in mind, we found that what informal settings could offer to such less structured learning activities that require greater spontaneity and wit in identifying or creating learning opportunities (rather than, e.g., doing teacher-imposed work sheets) is virtually limitless.

What roles did ICT play in the study? The smartphones seemed to be used in a minimalist way – for photo taking, sentence making and artifact uploading. However, it was our learning design that made the students maximize their learning by exploiting the two prominent mobile affordances – mobility and personalization. The instant playback feature of the built-in camera enabled them to check a photo right after shooting, and decided whether a retake was needed to ensure correct execution of their idea and appropriate association of the idiom. In some cases (Figure 2a and 2b), checking the playback might even trigger new ideas. In addition, students often browsed their photo albums on their phones that contained photos taken across locations and time. Some proceeded to create new artifacts arisen from "old" photos, or even "picking and mixing" several photos (e.g., Figure 1a, except that one photo was taken with another camera) to create artifacts. In turn, they had transformed their smartphones from a productive tool to a cognitive tool. We consider this the seamless stitching of suitable learning resources that a learner picks up along her on-going learning journey to mediate the latest learning task.

## 8. Conclusion

We have unpacked the students' artifact creation processes in the seamless language learning experience of "Move, Idioms!", particularly those taking place in informal learning contexts. Through our investigation of students' cognitive processes in artifact creations, we identified various patterns of students' artefact creation processes and gained better understanding of how the physical settings, parents and technology had played their parts in mediating such activities. The three stated elements of mobile learning had been exposited separately in the literature. However, we may be the frontrunners who investigated all of them within the same study in the context of mobile seamless learning, with relevant empirical learning process data being collected and analyzed. These findings will inform us of refining our design for learning experience in the next cycle of study to foster a more seamless learning experience, such as placing greater emphasis on Type 2 and Type 3 artifact creations during Activity 1 lessons, and introducing measures to motivate more parental involvements in their children's Activity 2 and Activity 3 tasks. In short, we hope to contribute to the literature of mobile seamless learning by exploring virtually limitless learning opportunities that informal learning contexts and parental involvement may offer to learners, with the support of mobile technologies.

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