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Genius Hour Assignment: Choosing ICT for Second and Foreign Language Instruction – A New Framework

Introduction

Research suggests that ICT in the form of applications, online resources, social media, simulations, gaming and digital publishing are excellent options for teachers looking to give their students a meaningful experience and much-needed practice in a target language. (Allen, 2007; Franciosi, 2017; Purushotma et al., 2009; Stepp-Greany, 2003; Ziegler, & Feucht, 2012)

In their guide to selecting ICT resources, Anthony Bates and Gary Poole (2003) point out that existing frameworks are often task-specific, remarking that "[f]irst, most concentrate primarily in matching a particular medium to a particular, fairly short, instructional event, such as reading a map. In such models, the teaching or learning process is fragmented into basic elements of activity (for example, understanding the symbols on a map) against which a particular medium is selected. (p. 76)

While teaching a language may seem a specific task, many immersive second language programs, such as Canadian French Immersion program, are content-based, meaning that the language is absorbed through the teaching of concepts not directly related to the language itself. Language is the medium through which the concepts are taught, and not necessarily the focus of a particular lesson.[1]

This reality compounds the technology selection process for teachers, as they must first choose tools appropriate to their students' second language proficiency before even considering the applicability of a tool to the topic of study. Adding a second language into the mix also increases the possibility of "cognitive overload" a concept first proposed by John Sweller (1988).

STAGES of SECOND LANGUAGE ACQUISITION

The dominant theory of second language acquisition[2] is the one proposed by Krashen and Terrell in 1983. In it, they theorise that students learning a second language move through five predictable stages: Preproduction, Early Production, Speech Emergence, Intermediate Fluency,

[1] In their paper, Ziegler and Feucht advocate *against* the content-based approach to language learning until the age of 7 (or Grade 2) based on children's cognitive development up to that age. (Ziegler, & Feucht, 2012) L. Quenton Dixon and colleagues also argue that "the research is quite robust that, holding hours of instruction constant, older learners perform better on measures of L2 proficiency…" (Dixon et al. 2012) What does this mean for the current approach to French Immersion instruction in Canada?

[2] A separate field from first-language acquisition research.

and Advanced Fluency (Krashen & Terrell; Robertson & Ford; Hill & Miller; Room 241) These stages are explained in the following table:

(Fig. 1) Krashen & Terrell's Stages of Language Acquisition

Stage	Characteristics	Approximate Time Frame
Preproduction	The student • Has minimal comprehension. • Does not verbalize. • Nods "Yes" and "No." • Draws and points.	0–6 months
Early Production	The student • Has limited comprehension • Produces one- or two-word responses. • Uses key words and familiar phrases. • Uses present-tense verbs.	6 months–1 year
Speech Emergence	The student • Has good comprehension. • Can produce simple sentences. • Makes grammar and pronunciation errors. • Frequently misunderstands jokes.	1–3 years
Intermediate Fluency	The student • Has excellent comprehension. • Makes few grammatical errors.	3–5 years
Advanced Fluency	The student has a near-native level of speech.	5–7 years

(adapted from Hill and Miller, p. 12)

Research has suggested that the acquisition of a second language can take from five to seven years under favourable conditions, (Collier, 1995c) though acquisition may take longer in less than ideal circumstances. (Hill and Björk, p. 19) Both scenarios presume immersion in a second language environment, so the applicability of these results to the Canadian French Immersion situation is debatable.

Nonetheless, Manitoba curricular expectations for reading fluency in FL2 students roughly match the five-to-seven year timeline proposed in Krashen's model. Provincial guidelines suggest independent native-language reading competence should be achieved by the end of Grade 3 and comparable fluency in French by end of Grade 4. (Ministère, 2009) A guidebook for administrators considering instituting a French Immersion program goes on to say:

> "Quantitative and qualitative research findings into the English skills of immersion students are clear and consistent. After an initial lag lasting until a year or two after English language arts is introduced (typically in Grade 2), early French immersion students perform as well in English as their English Program counterparts (by Grade 4, usually)." (Manitoba, 2007, chap. 2, p. 7)

Although reading outcomes for French Immersion students begin to approach FL1 reading outcomes in Grade 4, such students can hardly be considered fluent in this author's experience. Students' oral performance more closely equates to the "Speech Emergence" stage of Karshen's language acquisition stages. It can be hard getting students to advanced fluency because they aren't typically exposed to more advanced vocabulary outside the classroom, slowing their

progress. Constructivist approaches, including appropriate ICT, are necessary to achieving full fluency in a second language under such circumstances.

CONSTRUCTIVIST LEARNING THEORY

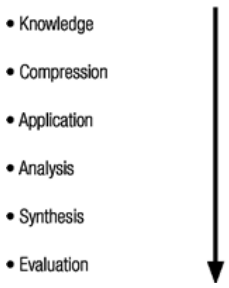
The constructivist learning approach builds on two major theories of childhood cognitive development, those of Jean Piaget and Lev Vygotsky.[3] In Piaget's model, children either assimilate new information into their existing knowledge base (or schema) or they adjust their schema to accommodate the new information. Children can move from one stage to the next once a balance (or equilibrium) is reached between assimilation and accommodation.

In his Social Development Theory, "Vygtosky coined the term *zone of proximal development*, which refers to the ideal level of adult/older child support or assistance that a child needs to learn a new skill." (Armstrong et al., 2014, p. 24) The zone of proximal development is "that gap between what students can do on their own and what they can with the help of more knowledgeable individuals…" (Hill & Björk, 2008) The provision of supports and structures conducive to student learning is called "scaffolding".

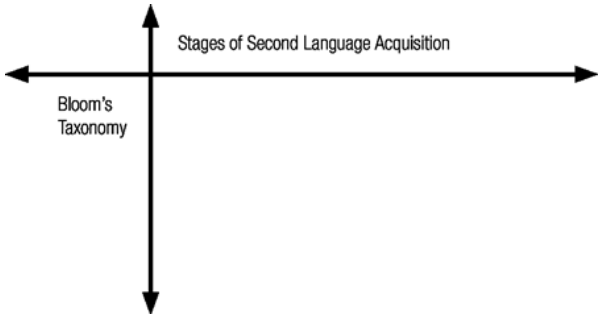
A teacher adopting the constructivist approach allows students the freedom and the tools to build their own understanding of a subject (aligning with Piaget's tenets), while acting as a guide and mentor to students (Vygotsky's model). They "incorporate various technology tools with active learning while allowing for teachers to act as guiding partners […] while providing rich environments and experiences for collaborative learning…" (Yang & Walker, p. 210)

Constructivist approaches blend seamlessly with Bloom's Taxonomy of Educational Objectives (Bloom et al., 1956), as the goal in both models is to guide students through carefully scaffolded and structured activities that prioritise higher-order learning. The relationship between these approaches and Krashen's Stages of Second Language acquisition aren't parallel, however, but perpendicular, as illustrated in the following chart:

(Fig. 2) Bloom's Taxonomy (highest order thinking at bottom)



(Fig. 3) Relationship Between Bloom's Taxonomy and the Stages of Second Language Acquisition



(Both figures reproduced from Hill & Björk, 2008)

These charts illustrate a common fallacy among educators teaching a second language: That students who are not yet speaking in a second language aren't capable of higher order thinking.

[3] Please refer to annex 1 for a table comparing the two approaches.

> You may ask yourself, "How can I possibly ask a Preproduction or Early Production student a high-level question if the most that student can do is point or give a one-word response?" Do not mistake an ELL's [English Language Learner's] limited output for an inability to think abstractly. (Hill & Björk, 2008)

The inverse scenario can also be true. Some students can produce phrases – and often read – fluently without fully grasping the meaning of those words. Needless to say, new vocabulary that is meaningless is rarely retained by students.

CONSTRUCTIVISM and ICT

Bearing these lessons in mind, it is imperative that second language educators choose resources, including ICT, that induce higher levels of analytic thought wherever possible. Resources that encourage creativity are more likely to meet students at their individual zone of proximal development while allowing them to adapt existing schemas or to build new ones.

Second language vocabulary and concepts encountered in this context are much more likely to be retained because the lessons have meaning for the student, a principle espoused by Michael Allen in his instructional design series. (Allen, 2007) To whit "…if computers [are] used for drill or practice, they typically [have] a negative effect on student achievement. Meanwhile, it they [are] used with real-world applications, such as spreadsheets, or to simulate relationships or changing variables, student achievement increase[s]." (Leneway, p. 8)

Reinforcing these approaches, Ed Smeets (Smeets, 2005) lists the "four main characteristics of powerful learning environments":

- [R]ich contexts and tasks that are as authentic as possible are provided to present links to the world outside school;
- [A]ctive and independent learning is stimulated;
- [C]o-operative learning is stimulated;
- [T]he curriculum is adapted to the needs and capabilities of the individual pupils.

The terms "Active Learning" and "Task-Based Learning" also appear frequently when discussing ICT applications in the classroom. Both concepts focus on particular aspects of constructivism in education. Active Learning promotes student-centred inquiry (Ntuli, 2015) while Task-Based learning encourages higher order thought through problem-solving exercises (ESOL).

Since the computer revolution, existing taxonomies have also been adapted to guide ICT selection in the classroom. Bloom's taxonomy has been updated to reflect the needs of modern educators navigating the digital frontier (see Annex 2). Other researchers have focused on identifying the technologies best suited to Piaget's stages of childhood cognitive development (see Annex 3). This chart is particularly useful when choosing the appropriate tools for social media integration.

ARCC: A NEW FRAMEWORK for GUIDING ICT SELECTION in SECOND LANGUAGE EDUCATION

Existing frameworks are excellent tools for guiding educators' choices when integrating ICT into their classrooms, but they don't deal explicitly with the needs of second or foreign language learners. Stephen Krashen (the originator of the stages of second language acquisition) has

weighed in on the topic of language teaching in the digital age, although his recommendations are particular to the needs of ESL educators like himself (Krashen, 2016).

The following is a framework that can be adapted to help guide the selection of educators teaching any second or foreign-language students. The framework particularly targets students whose environments provide little to no opportunities for second-language interactions outside of the classroom. Ideally, educators at all grade levels, including post-secondary instructors, could find this framework pertinent to their circumstances.

This framework is inspired by, and builds upon, constructivist approaches to encourage higher-level thinking and learning wherever possible, while accepting that these higher levels are built upon the acquisition of lower-level skills. The framework was first developed without any knowledge of Krashen's stages of second language acquisition, and has subsequently been refined to reflect the research that Krashen and others have undertaken in second language research.

(Fig. 4) ARCC: ABSORB, RECALL, COMPREHEND, CREATE

A	**Absorb** – Students absorb new vocabulary through listening and viewing.	Examples: Videos, songs and audiobooks, non-educational video games featuring plenty of dialogue.
R	**Recall** – Students repeat new vocabulary and phrases, without necessarily fully understanding their structure or appropriate uses.	Examples: Matching drills, electronic flashcards, word searches, many language learning applications and programs.
C	**Comprehend** – Students understand input from the target language and can answer questions in that language independently.	Examples: Content-based tests, target language quizzes, puzzles with specific outcomes, simulations, language applications requiring phrase translation and sentence assembly.
C	**Create** – Students share ideas and explore concepts using the target language.	Examples: Writing emails, blogging, video and audio creation and editing, social media posts in the target language.

ABSORB: This is the lowest level of language activity in the framework. It is equivalent to the preproduction stage in Krashen's model. It's very popular among educators because it exposes students to large amounts of vocabulary in a short time, and it also tends to calm a class as they must listen to or view the material quietly. ICT of this sort tends to take the form of movies, video clips, songs and audiobooks.

These forms of ICT are not bad, in and of themselves, and they have a place in the classroom. Students can't possibly absorb new vocabulary words and concepts in the target language if they've never been exposed to them. The danger, however, is in triggering "cognitive overload" by overwhelming students with too much information. The likelihood of new terms being retained is also very low due to the passive nature of the experience.

Best practice when using ICT from the Absorb level would be to choose material that presents a limited amount of vocabulary or concepts at one time. The context of the material should be clear and relevant to the students as well. Another option is to introduce material that is familiar to students (a favourite movie, game or song, for example) that has been translated into the target language, reducing cognitive load.

RECALL: This level is also a necessary step toward higher-level thinking as it requires the recall of vocabulary terms and concepts by students. This category is comparable to the Early Production stage in Krashen's model. Tools that involve rote memorization, such as matching exercises and flashcards are popular iterations of this level of ICT integration in the classroom.

Again, students must pass through this stage if they are to reach higher levels of language acquisition. There is no substitute for having students repeat words and phrases as often as possible, even if the exact mechanics of the terms elude them. A particularly successful teaching method, AIM[4], gets students speaking quickly through the use of hand gestures and an approach that insists on students talking wherever possible rather than teachers. Simple recall has a place in language instruction, though educators should not limit themselves to this stage.

Many language learning applications are rooted firmly in the Recall category. While the formats of the activities may vary, they are at their heart practice and drill exercises in novel packaging. There are ways of making this stage much more engaging however, through the judicious use of ICT. Having students record themselves repeating phrases, creating digital dictionaries and using digital avatars can make this stage much more engaging and memorable for students. A few applications also use voice recognition software to encourage speech production from students.

COMPREHEND: This is the stage where students understand much or most input (audio, video, text) in the target language, but they're not yet capable or confident enough to use the target language creatively. This level inhabits a space somewhere between the Speech Emergence and Intermediate Fluency levels on Krashen's model. In elementary immersion settings, students may be adept at using previously tackled concepts, but their proficiency level changes as they encounter new vocabulary and concepts.

This problem is particularly pernicious in the content-based instruction setting, such as that encountered in Canadian French Immersion programs. Students tackling Science, Social Studies and other subjects must first overcome the hurdle of learning a whole new vocabulary for those themes, thus preventing in-depth exploration of the content and incurring cognitive stress. Students end up with good surface knowledge (at least until the test) but deeper meaning – hence, retention – eludes them.

Typical ICT resources used at this stage might be online quizzes, puzzles and other activities with very specific, content-based outcomes. Simulations can fall into this category, depending on the level of interaction required by the user. Attempts at using more rigorous tools and materials are often stymied by a lack of language proficiency, particularly if the material has been written for native speakers of the target language.

CREATE: ICT resources at this level provide the flexibility that learners in the lower levels of language acquisition need to truly understand and retain new vocabulary while still exploring

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[4] Accelerated Integrative Method. For more information visit: http://www.aimlanguagelearning.com/

concepts in a way that is meaningful to them. These are the kinds of resources that get students organising the material in a way that makes sense to them (developing a schema) while allowing them to explore the material at a comfortable pace (zone of proximal development). They are the resources that get students creating content and using language in a meaningful way, improving their proficiency. ICT resources in this category are most likely to advance second language proficiency, in this author's opinion.

ICT tools in this category include concept mapping (which can be used as early as kindergarten), word processing, creating infographics, video and audio recording and editing, social media, video, audio and text chatting, email and discussion posts, and more. The main objective in these cases is to get students solving problems, thinking creatively, and exploring a second language on their own terms.

ARCC in ACTION

Application of the framework is straightforward. When considering an ICT resources, educators analyse the resource to decide where the resource sits in the framework. In the following example, the online voice avatar website Voki.com[5] is analysed. Voki allows users to input audio files, typed text or recording themselves. This input is then used to animate a wide variety of avatars in real time:

RESOURCE: Voki.com	
☐ ABSORB	Applications: While the avatars could be used by the teacher to present new vocabulary, other avenues are perhaps preferable.
☑ RECALL	Applications: Students could record themselves attempting new vocabulary in the target language. Those recordings are then be shared and referenced.
☑ COMPREHEND	Applications: Students view other recordings to see if they understand the messages of their peers.
☑ CREATE	Applications: Students create original scripts in the target language that are acted out by the avatars, such as mock news reports or interviews. Students collaborate to create skits or to exchange messages using the format.

It is apparent that a tool can have applications across many categories of the framework. Bear in mind that wide applicability of the tool does not mean that it is inherently superior to resources with a narrower focus.

The analysis is again attempted with the online and app-based Popplet.com[6] concept-mapping application:

RESOURCE: Popplet.com & Popplet App	
☑ ABSORB	Applications: Students arrange pre-made popples into a map while seeing images associated with their textual names in the target language. Links to audio recordings can be added to popples.
☑ RECALL	Applications: Students link images to their sound and textual equivalents.

[5] http://www.voki.com/

[6] http://popplet.com/

☑ COMPREHEND	Applications: Students adapt or utilise pre-made resources (including text, links to video and audio recordings) to create concept maps.
☑ CREATE	Applications: Students write original text and create original resources (including video and audio recordings) in the target language to create concept maps.

This application also fits into several categories and demonstrates its flexibility across a wide range of user cognitive abilities and language proficiencies.

Although some very good tools exist that only fall into one category on this framework, educators should approach them with caution. Any resources that require a significant investment in time and training to master may not be worth the effort if the tool cannot be used later on for higher order lessons and projects.

CONCLUSION:

Choosing ICT for integration in a second or foreign language classroom can seem like a daunting task for many educators. Identifying resources that also motivate students to use higher-order cognitive skills can also be a challenge.

The ARCC framework does not identify tools based on cognitive development levels, however. Nathan Ziegler and Florian Feucht's framework is the best existing tool for identifying tools based on Piaget's theory of childhood development. The author is currently developing a framework for guiding educators' ICT choices based on elementary students' fundamental skills (computer navigation, keyboarding, etc.)

The ARCC framework has the potential to provide educators with a tool that helps them quickly identify the ICT tools most likely to result in enhanced vocabulary acquisition and retention in a target language. It asks educators to consider whether or not a tool can be applied to support higher-order learning. It is important to remember that the interface of a given ICT resource does not necessarily have to be written in the target language, but it must enable work in that language to be effective.

ARCC may potentially assist educators in identifying resources with the greatest flexibility for meeting the needs of learners having a wide variety of cognitive abilities and second language skills. Research will be required to verify whether or not the ARCC framework lives up to these claims.

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Annex 1

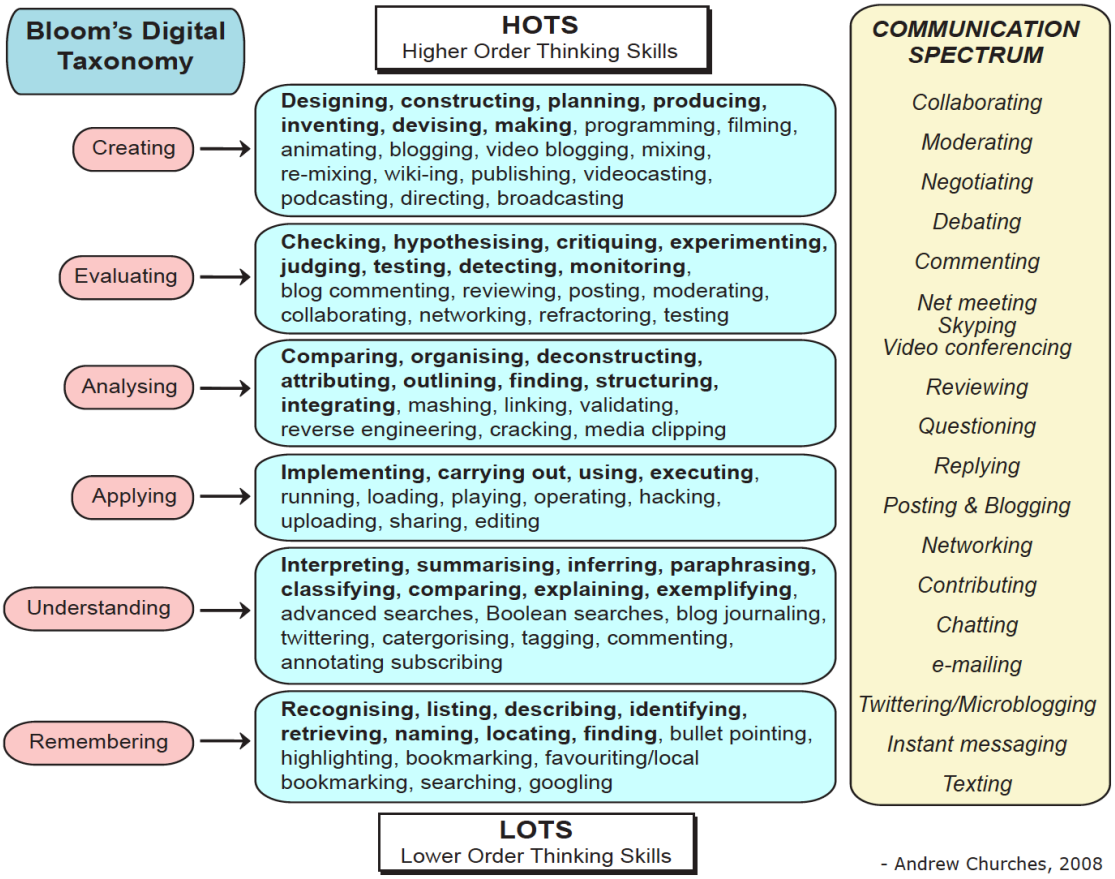
A comparison of Jean Piaget and Lev Vygostsky's models of childhood cognitive development.

	Piaget	Vygotsky
Defining Characteristics	Stages, development drives learning, learner centered	Social interactions, Zone of Proximal Development, learning drives development
Mechanisms of Change	Innate development, stages, assimilation, accommodation, equilibration	Scaffolding, social interactions, cultural development, internalization
Readiness	Genetic development growth, biological stages, has to be developmentally appropriate	ZPD has to contain the capabilities that are being taught, scaffolding
Role of Student	Actively manipulates objects/ideas, continually invents/reinvents knowledge through interaction with the world	Interact with instructor, peers, and socio-cultural environment to solve problems.
Role of Teacher and Classroom	Provide environment that encourages students to interact and ask probing questions.	Engage learners in socially-organized activities, provide scaffolding for learner.
Endpoints	Hypothetically everyone can reach the endpoint.	Learning how to think.

(Source: Jayce, 2013)

Annex 2

Bloom's Digital Taxonomy:



(Source: Toronto, page 2)

Annex 3

Cognitive development, second language methods, and technology: An integrated framework to assist the second language teacher.

Four Stages of Piaget's cognitive development	Sensorimotor	Preoperational	Concrete operations	Formal operations
	Birth to 2 years	2 to 7 years; Preschool age	7 to 11 years; School age	11 years and older; School age
	Cognitive ability to use images, words, and gestures that represent objects and events that are presently perceived in their immediate environment.	Cognitive ability to refer to people, objects, and events that are not physically present and to use words to talk about problems while not yet able to solve them logically.	Cognitive ability to effectively think and talk about concrete objects and events and to solve practical, real world problems using trial and error.	Cognitive ability to effectively think and talk about abstract objects and events and to solve hypothetical problems logically.
Five methods of language leaning and acquisition	Hard-Science-Linguistic	Audio-Visual- Lingual	Audio-Lingual Communicative-Language-Teaching Content-Based-Instruction	Grammar-
Technology to facilitate language learning and acquisition	**Concept Mapping** Video Input	Simulation & Gaming Video Chat	Chat Email Blogging	Discussion

(Source: Ziegler & Feucht, p. 153)