PAL: A provocative framework for assessment and evaluation of 'timeless' topics in technology-driven 'classroom' learning environments

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Abstract Twenty years after its first application, the Integrated Science Learning Environment model (ISLE) proved still-useful in catalyzing novel thinking about the role of artifacts in shaping Holocaust remembrance at the graduate level. Drawing on new ideas from museum science and technology design, an updated framework, called Provocative Artifacts for Learning (PAL), accounts for advances in educational technologies, mobile capabilities, and 21st-century pedagogy. This paper provides a brief description of the historical development, practical design, and use of the PAL model. Because PAL encompasses two separate but linked items (defined as A1 and A2), the different sides of the axes are related but not antithetically (as in assessment versus evaluation). The meaning-making around A1 develops from the evaluation of place, time, and person, bringing to light critical issues regarding access, bias, and provenance. The sense-making around A2 is revealed in the assessment of the mechanics, dynamics, and discovery evidenced in the final product or outcome of the activity that promotes critical voice, shared control, and student negotiation. In creating A2, students apply what they learned from evaluating A1. In assessing A2, teachers provide feedback that is directly related to the study of A1. In today's rapidly changing techno-culture, this new approach to evaluation gives traditional topics a new relevancy. In turn, practicing the agnostic skills of judging the influencing (often hidden) aspects in both directions allows learners to experience iterative knowledge discovery supported by metacognition. Giving agency to students empowers them to appreciate and personalize new knowledge can lead to transfer. This 'next-generation literacy' likely will be able to transfer across domains we cannot yet imagine. PAL seeks to help educators find the right balance to perpetuate an integrated culture (milieu) in which humans maintain control over decision-making processes, individually and for the collective good. (Includes 5 figures and 3 tables, including 2 scoring rubrics, along with 10 footnotes and 23 references.)

Keywords learning environments, knowledge discovery, enabling technology, 21st-century pedagogy, evaluation, assessment

Introduction

Twenty years after its first application (Nix 2002), the Integrated Science Learning Environment model (ISLE) proved still-useful at the graduate level in catalyzing novel thinking about the role of artifacts in shaping Holocaust remembrance. Drawing on new ideas from museum science (Giannachi 2016; Bernard-Donals 2017) and technology design (Krippendorff 2005; Balsamo 2010), a complementary framework called Provocative Artifacts for Learning (PAL) accounts for advances in educational technologies, mobile capabilities, and 21st-century pedagogy. Extending ISLE in another direction as well as across other domains, PAL introduces an original approach to the evaluation of existing works and the assessment of derivative outcomes. Given the successful tradition in learning environments research (Fraser 2002) of combining scales or modifying instruments (Nix et al. 2005), PAL also offers new opportunities for measuring the new learning environments impacted by new teaching practices.

Today's 'big data' methods (Mayer-Schönberger and Cukier, 2014) are changing methodologies throughout scientific and philosophical studies. Innovative applications of enabling technologies offer infinite ways to leverage the benefits of machine-reading, multiple other forms of 'artificial intelligence' (AI), and future research tools. My vision for 'digital literacy' within ISLE was – and still is – to cultivate 'information artisans' (IAs), *without* conceding human control in/of the process. Unlike a computer, "we can't get inside and rewire a brain, but we can arrange things so that it gets rewired. If we are skilled, we can set up conditions that favor this rewiring, and we can create an environment that nurtures it" (Zull 2002, p. 5). Empowering humans to make their own connections from their individual perspectives may lead to deeper understanding about complex topics, like the Holocaust, and how it continues to remain relevant. The technology exists[1]. Visual, semantic, and computational tools and techniques are being used in most every arena of various 'schools' of thought. Innovative approaches to teaching and learning in many of today's technology-rich 'classrooms' (formal and informal) set the stage for virtually unlimited possibilities to foster a spirit of life-long learning (Davidson 2017) – *if* we find effective ways to support personalized learning and to manage collaborative experiences practically.

ISLE presents a multi-faceted design to address the three basic forms of learning: acquisition of knowledge, change in emotions or feelings, and gain in physical or motor actions or performance. Whereas ISLE was used to conceptualize the curriculum design of a program (Nix 2012), PAL provides a framework for practical implementation at the project level. In each case, the aim is to help learners think differently (de Bono 2010) about 'traditional' topics through participatory knowledge discovery. As a social constructivist, I broadly define discovery learning (also referred to as problem-based, experiential,

[1] For example, the MOHO Knowledge Discovery Platform is highly scalable and enables distributed, real-time knowledge discovery through a single information view.

and 21st-century learning) as a technique of inquiry-based learning supported by the work of Jean Piaget, Jerome Bruner, Seymour Papert, and others. In *From Brain to Mind: Using Neuroscience to Guide Change in Education*, Professor of Biology and Biochemistry James Zull goes on to articulate the urgency of introducing PAL into secondary (and tertiary) education:

> Discovery is an essential point along the thread. It is necessary if random action is to lead to metacognition. In fact, discovery is the ultimate goal. We want to experience the conversion of unconscious sensory experience into conscious awareness of a meaning, concept, or relationship. Perhaps the central aspect of discovery is ownership. When we discover something, we start believing that we own it… (Zull 2011, p. 261)

The notion of post-digital humanities (Hall 2013) compelled me to re-examine ISLE in the context of our present techno-culture (Balsamo 2011). Subsequent work will delve into the extensive theoretical underpinnings of the various 'drivers' that work together within the inextricably linked PAL framework. This paper describes the practical structure of PAL from an educational point of view. With this general introduction, a brief review of the historical development of PAL is followed by a detailed description of the framework and examples of assessment and evaluation rubrics. Finally, specific implications regarding digital discovery of artifacts and the significance of PAL are discussed.

Historical Development

Informed by several implementations of ISLE for practicing science teachers, I wrote and built an online educational technology course for pre-service teachers and graduate students interested in creating tools and sharing applications for educators. Delivering it over the next 20 years, I revised the course content to maintain its relevancy as both technology and pedagogy interdependently changed. Infusing this new knowledge and experience into my practice led to successive generations of ISLE. This section describes the evolution of ISLE through TILE to PAL, as related to the Internet and educational technology.

To summarize the historical development of PAL, Table 1 matches the general progression of the Internet to these learning environment models and key influences on educational technologies, in addition to previewing the next revolutionary iteration. I sought out these tools to help myself, our teachers, and their students manage fully-informed decision-making.

Table 1. Timeline of critical information and communication technologies (ICT) leading to PAL

Basic Web Evolution	Learning Environment Model	Influence of Educational Technology
1994-2000 Web 1.0: Information Web *(read-only)*	ISLE: Integrated Science Learning Environment (Nix, introduced in 1999)	Digital Immigrants | Experiential Training + Knowledge Transfer (process approach to ICT for Lifelong Learners) *effective > affective*
2000-2010 Web 2.0: Social Web *(read-write-publish)*	TILE: Technology-enabled Integrated Learning Environment (Nix, introduced in 2009)	Digital Habitats | Information Foraging Theory + Online Course Design (affordances of ICT for Teaching) *intentionally-linked learning cycles*
2010-2020 Web 3.0: Semantic Web *(mobile & personal)*	PAL: Provocative Artifacts for Learning (Nix, introduced in 2018)	Digital Humanities | Iterative Discovery + Participatory 'Prosumers' (collaborative inquiry-based learning) *digitally-literate decision-makers*
2020-2030 Web 4.0: Intelligent Web *(emotional/symbiotic)*	To be determined through future iterations[2]	Examples of key technologies being/to be developed include Semantic Social Networks, Semantic E-mail, Context-Aware Games, and Better Natural Language Processing

ISLE (the Integrated Science Learning Environment model) was explicitly designed to catalyze long-term change in practice by creating an essential foundation for individual internalization and direct knowledge transfer into other contexts. For example, through an extended field trip to a natural area, the aim was to increase constructivist teaching in middle school classrooms with a process approach to information technology. The final product of that ISLE program (virtual field trip) was constructed by linking the elements common to the supporting learning environments (university classroom, field trip, and information technology) at their basic levels: newness, massiveness, and appropriateness. The genericized Figure 1 illustrates how the conceptual framework is shifted from an effective perspective (pertaining to physical aspects) to an affective perspective (pertaining to emotions or feelings) to develop an integrated (three dimensional) learning environment. Figure 1a shows the traditional framework with three separate and perpendicular planes in which activities occur independently from the other. Figure 1b shows the single and integrated plane that is constructed by addressing the key issues of each separate learning environment at their common level. On this new 'playing field', activities can occur contiguously throughout the three learning environments.

[2] "…a rigorous understanding of what the humanities can become in an era of networked digital information machines." – Gary Hall, 2013.

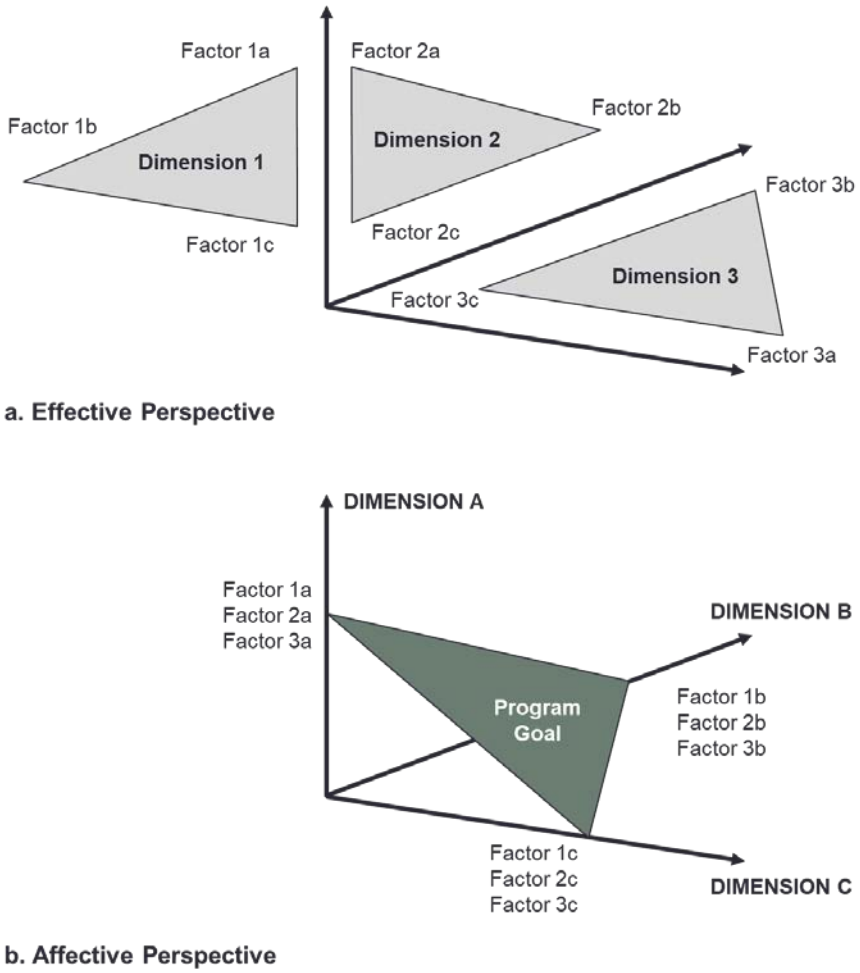


Figure 1. ISLE shifting of perspectives from the effective to the affective

Moving past the logistics of technology integration into the challenges of leveraging technology in the classroom took the next variation of ISLE beyond the realm of science education. TILE (the Technology-enabled Iterative Learning Environment context) derives from pivotal advances in technology that have driven major changes in how we manage the 'business' of teaching and learning today. Represented in Figure 2, three traditionally-separate learning cycles are intentionally embedded within a functional system. Given first-hand experience in using the MOHO Knowledge Discovery Platform for academic research, I inserted the iterative discovery cycle (reach, find, analyze, monitor) used by most data analysts within the experiential training cycle (experience, reflection, generalization, and application) that 'powered' ISLE. Emphasis is placed on the processing that is catalyzed between the stages, as indicated by the four internal 'loops'. Around that, four fundamental types of thinking (critical, constructive, creative, and computational) provide universal guideposts for discovery-centered assignments.

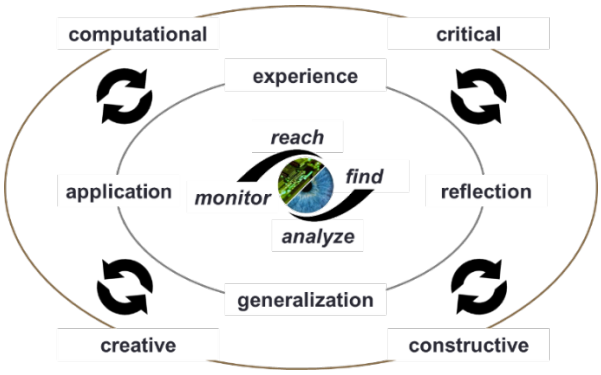


Figure 2. TILE intentionally-linked learning cycles

With the common plane (ISLE) and 'power source' (TILE) further informed by McLuhan's perspectives[3] on 'medium/message' and adapting Turkle's notion[4] of 'evocative objects', PAL (the Provocative Artifacts for Learning framework) emerged. Offering a practical tool for both teachers and students, within mirrored planes formed by three paired axes (place/mechanics, time/dynamics, and people/discovery) an original creation (Artifact 1) can be evaluated in the same way a new or derivative work (Artifact 2) might be assessed. Beyond the scope of this paper, paradigm shifts from the field of digital humanities and rhetoric from museum studies finally offered names for what I knew eluded me in my doctoral study. The semantic turn[5] drives the dynamics of the system while the computational turn[6] illuminates the mechanics and the visual turn[7] influences interpretation and discovery. Baert (2016) describes the 'aha' moments that occurred across the ISLE 'playing field' when each individual learner was ready to learn.

> Kairos alludes to a complex system of meaning that unites time and space, qualitative and quantitative elements, in a hermeneutic splice, an intersection so perfect that it provides the only possible occasion. This knot is 'opportune' for intervention, where the moment is '(re)markable'. If one parameter of the intersection is lacking or out of balance, the knot is insecure and the occasion does not present itself. (p. 195)

Examining existing works in a new way enables students to produce new works which in and of themselves enrich the original work and integrate the use of 21st-century skills and literacies. At the same

[3] "We shape our tools. And later our tools shape us." – John M. Culkin (on Marshall McLuhan), 1967.
[4] "We think with the objects we love; we love the objects we think with." – Sherry Turkle, 2007.
[5] "Design is not only about making things but also fundamentally about making sense of things." – Klauss Krippendorff, 2005.
[6] "Scholars are using technologies to shift the ground of their concepts and theories." – David M. Berry, 2011.
[7] "As social media driven by the hyper development of visual technologies have come into being, there has been an undeniable shift in emphasis toward an increasing importance of the visible – and how it is and can be manipulated. This puts the spotlight on the social significance and function of visual culture." – W. J. T. Mitchell, 2006.

time, it stimulates a growth mindset bundled into a process of understanding that is open, rather than closed. An intentionally-designed constructivist learning environment supports the transfer of knowledge (memory), which, in turn, can effect changes of habit and of behavior that may lead to action. Detailed in the following sections, Figure 3 basically illustrates the elements surrounding evaluation of Artifact 1 (access, provenance, and bias) that influence meaning-making and the consequent sense-making evidenced in Artifact 2, which relate to three scales of the Constructivist Learning Environment Survey (Taylor et al. 1997): critical voice, shared control, and student negotiation.

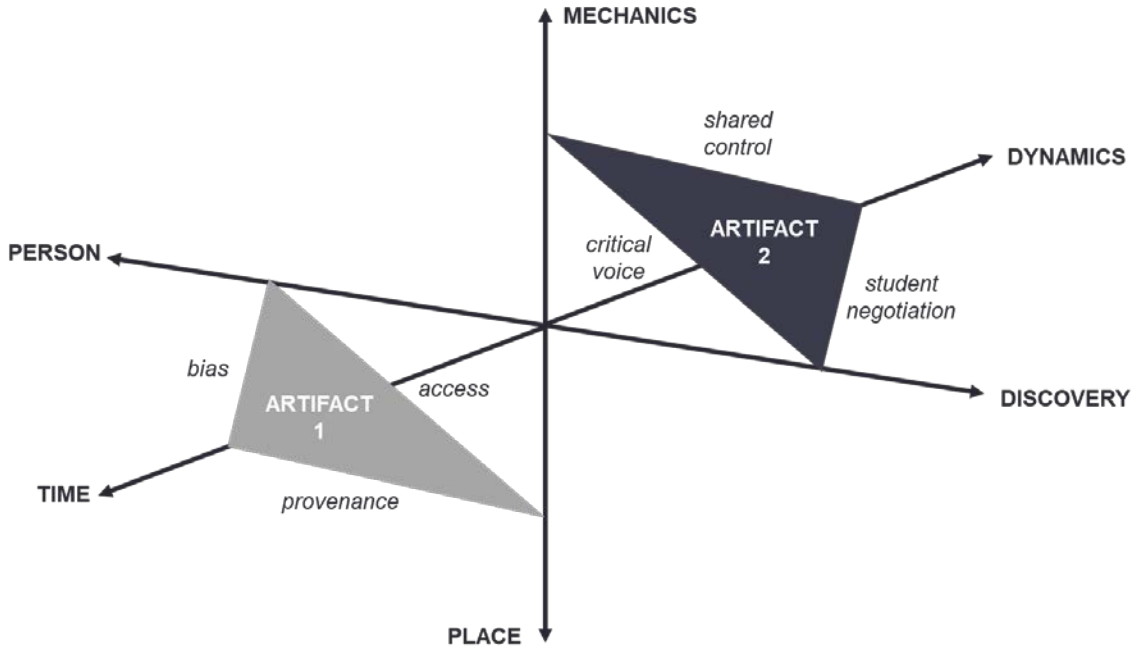


Figure 3. PAL promotes literacy and relevancy for consumers (through evaluation of an existing article) and for producers (through assessment of a new article)

The end goal of the PAL model is knowledge transfer that could transform digital prosumers (producers and consumers) into 'everyday scholars' with 'thinking and doing' in the classroom that leads to proactive life-long learning in the real world. Even at the start of this millennium, the proliferation of information, growth of the World Wide Web, social networking, and the increasing mobility provided by telecommunications was stretching our multi-tasking abilities and increasing the pressure to make snap choices, thus sacrificing our ability to think deeply and to go beyond initial perceptions and popular selections based on initial perceptions.

PAL Framework

This paper details the development of a practice-led model for assessment and evaluation in a digital age. As Fraser (2012) aligned learning environments research with research on social climates and the psychology of educational productivity, I am combining ideas from established areas that are new to me, namely design and memory, to define a new milieu. Teasing out the links woven throughout and around original artifacts and derivative works, PAL facilitates the examination of key influencing factors of time, place, and persona to investigate how current mechanics, dynamics, and interpretation shape (re)presentations. Building on ISLE at this most basic level, PAL harnesses the tools and techniques of our digital age in order to catalyze learning while stimulating the personal interests and abilities of the learner. The kairotic transition zone between the original artifact and the developing derivative work creates a space for change by focusing on the affective dimension of learning. The 'teacher' plays a vital role in saying or doing the right things at the right moment to 'provoke' understanding.

The 3D conceptualization of PAL is similar to the strategy used by Bautista and Balsamo (2013) to better understand the role of museums in the digital age, particularly how new technologies are affecting traditional museum practices and communities. Three axes define continuums in terms of location (physical – virtual), activities (open – closed-ended), and experience (fixed – mobile) in their analytical framework. Insights gained from their 'mapping' of the distributed nature of museology today led to cultural implications that suggest "opportunities for the creation of new learning experiences" (p. 68). Considering student production as a "practice of cultural reproduction", which Balsamo (2010) adds as a fourth meaning of 'design', "makes new things possible when the expression of a design may manifest something that has not yet been realized" (p. 2). This techno-cultural perspective helps to explain the viability of trends in 21st-century pedagogy toward active learning in technology-rich contexts. "Several decades of research support the view that it is the activity that the learner engages in, and the outcomes of that activity, that are significant to learning" (Beetham and Sharpe 2013, p. 31).

Because PAL encompasses two separate but linked items (defined as A1 and A2), the different sides of the axes are related but not antithetically (as in assessment versus evaluation, not in a positive or negative sense). The particular dimensions illustrated in Figure 3 derive from the specific factors listed in Table 2. Along with Figure 1, in the same way, other PAL topics can be defined simply by shifting perspectives from the effective to the affective as implemented for ISLE. The meaning-making[8] around A1 develops

[8] See Etienne Wenger's work on communities of practice and social learning systems.

Table 2. PAL dimensions and factors for effective and affective evaluation of A1 and assessment of A2

Artifact	Perspective	Dimension	Factors
A1 (original)	Effective	PUBLICATION	Producer Origin/Provenance Exhibition/Preservation
		PURPOSE	Local Culture Personal Experience 'State of the World'
		PRODUCTION	Design/Dimensions Materials/Resources Creation Date
	Affective	PERSON	Personal Experience Design/Dimensions Exhibition/Preservation
		TIME	Producer Creation Date 'State of the World'
		PLACE	Origin/Provenance Materials/Resources Local Culture
A2 (derivative)	Effective	REQUIREMENTS	Development Guidelines Due Date Final Output
		CONTENT	Accuracy Completeness Sources
		CONTEXT	Subject Class Individual
	Affective	MECHANICS	Due Date Content Accuracy Subject Focus
		DYNAMICS	Development Process Sources Reviewed Class Context
		DISCOVERY	Final Output Completeness Personal Relevance

from the evaluation of place, time, and person, bringing to light critical issues regarding access, bias, and provenance. The sense-making[9] around A2 is revealed in the assessment of the mechanics, dynamics, and discovery evidenced in the final product or outcome of the activity that promotes critical voice, shared control, and student negotiation. In creating A2, students apply what they learned from evaluating A1. In assessing A2, teachers provide feedback that is directly related to the study of A1. Comparing and contrasting A2s across individuals or groups adds even more knowledge and understanding of A1 through multiple insights from tangential viewpoints.

In evaluating the original work (A1), 'person' refers to the creator of the artifact of interest – taking into account the producer's perspective, in consideration of the limits and opportunities associated with the work, and the historical influences on the final work. 'Place' refers to the actual location of where an artifact was created – taking into account available resources, the geographic location(s) in which the work existed/exists, and the influence of contemporary local culture at the time. And 'time' refers to a discrete chronological timeline of when an artifact was produced – taking into account the creation date period, the context of publication and its release date, and the age and experience of the producer of the work. Similarly, in assessing the related work (A2), 'dynamics' focuses on the creative decisions made in designing an artifact – that are determined in relation to specific circumstances and influences. 'Discovery' focuses on the impact of an artifact in terms of the embodiment of meaning – as it changes in different exhibition settings and uses over time. And 'mechanics' focuses on the choices of elements used to create an artifact – taking into account the available production technologies, accessible resources and individual skills of the producer.

For example, using PAL to explore the full context of 'the book' (Piper, 2012) as a provocative artifact rather than as an end in itself, my colleague outlined three representative case studies based on seminal Holocaust Literature[10] to address key concepts that can be transferred to the enduring themes of the Holocaust, antisemitism, and genocide. Summarized with permission, in the first case, A1 is the collection of Radnóti's poems in *Tajtékos ég* (the original Hungarian version) and A2 is Ozsváth's book, *In the Footsteps of Orpheus: The Life and Times of Miklós Radnóti*. Zsuzsanna Ozsváth's translations of the poems (published in English as *Foamy Sky*) in a new way – transcending cultural barriers by seeing what it meant to translate not just the words, but also the 'images' of the personally-relevant poetry – helped Ozsváth to better describe Holocaust poetry as a literary genre. This contributes to a better understanding of the Holocaust. In the second case, by challenging Steven Jacobs and Mark Weitzman to

[9] See Peter Pirolli's work on information foraging theory and human information interaction.
[10] See Christine Maxwell's work on *The Book as Provocative Artifact: A New Relevancy for Holocaust Literature in the 21st Century*, detailed in her doctoral dissertation for the University of Texas at Dallas.

publish their direct 1-to-1 refutation of the *The Protocols of the Learned Elders of Zion* (A1), Elisabeth Maxwell realized the potential meaning of *Dismantling the Big Lie: The Protocols of the Elders of Zion* (A2) for combatting modern antisemitism. Thirdly, close examination of the materiality of Anne Frank's *The Diary of a Young Girl* (A1) and the significance of factors surrounding its publication resulted in David Barnouw's critical investigation into *The Phenomenon of Anne Frank* (A2), thus showing how a holistic approach to the trivialization of the Holocaust might be used to help prevent future genocide.

PAL Scoring Rubrics

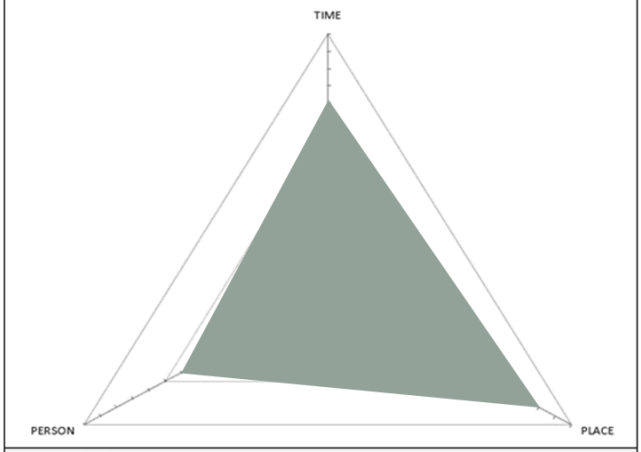
Two rubric templates are available to support the design and implementation of PAL activities. Figure 4 shows a PAL scoring example for the evaluation of an existing artifact (A1). Figure 5 shows a PAL scoring example for the assessment of a derivative artifact (A2). As a matter of practicality, the electronic version performs the calculations on basic points earned (0 = No, 1 = Okay, 2 = Good, 3 = Great) for five items on each of the dimensions of the appropriate framework (A1 or A2, evaluation or assessment). Table 3 lists the aspects for each dimension. The final score is represented as a total percentage, emphasizing the need for attending to both *content*, as in attention to details, facts, ideas (aspects 1-3 in Table 3) and *context*, as in connections within and among axes (aspects 4-5 in Table 3) to paint a complete picture. A grid is provided so that students can plot and connect the total points per axis to illustrate the completeness of their evaluation/assessment. Space is also provided for teacher feedback and learner reflections. Any of these values or labels could be modified to match other defining parameters.

Score:	Learner:	Artifact:
73%	Chris M	Anne Frank's Red Plaid Diary

POINTS PER AXIS		COMPLETENESS	
11	TIME	40%	CONTENT - attention to details, facts, ideas
13	PLACE	33%	*CONTEXT - connections within and among axes*
9	PERSON	73%	Both are needed to paint a complete picture.

Graphical Representation of PAL Score

(plot/connect POINTS per AXIS to define ARTIFACT assessment/evaluation completeness)



Learner Reflections:

I didn't much like this assignment. It didn't seem to have anything to do with me – until I learned more about where Anne's family had been and what all they had lost. A little book didn't seem like a lot to me, but I see how it was to her then.

AXIS	POINTS	ASPECT (0 = No, 1 = Okay, 2 = Good, 3 = Great)
TIME	3	*made a reasonable connection to PLACE*
	1	*made a reasonable connection to PERSON*
	2	took creation date/period into account
	3	considered context of publication/release date
	2	appreciated the age/experience of the producer
PLACE	3	*made a reasonable connection to TIME*
	3	*made a reasonable connection to PERSON*
	3	took production circumstance(s) into account
	2	considered context of artifact (re-)location
	2	appreciated the influence of the local culture
PERSON	2	*made a reasonable connection to TIME*
	3	*made a reasonable connection to PLACE*
	1	took the producer's perspective into account
	0	considered limits/opportunities of the work
	3	appreciated the 'history' of the actual object

Leader Notes:

I'm not sure that you completed all of the required readings for this assignment. There is a significant amount of context surrounding the reasons that Anne started writing her diary. Try to make more direct connections between her life before going into hiding and then to how her father must have felt on losing them all in the end.

Figure 4. PAL Scoring Example for Evaluation of an Existing Artifact (A1)

Score:	Learner:	Artifact:
87%	Chris M	Today's Entry for Anne Frank's Diary

POINTS PER AXIS		COMPLETENESS	
13	Mechanics	53%	CONTENT - attention to details, facts, ideas
14	Dynamics	33%	*CONTEXT - connections within and among axes*
12	Discovery	87%	Both are needed to paint a complete picture.

Graphical Representation of PAL Score

(plot/connect POINTS per AXIS to define ARTIFACT assessment/evaluation completeness)

Learner Reflections:

I am glad that I took the extra time to find the right image that I really wanted. I feel like I now understand what Anne must have been feeling (to a small degree).

AXIS	POINTS	ASPECT (0 = No, 1 = Okay, 2 = Good, 3 = Great)
MECHANICS	2	*made a 'sensibly-supported' claim/thesis*
	3	*made an aesthetically-interesting work*
	3	met deliverable schedule(s) in a timely fashion
	3	ensured accurate representation of content
	2	attended to the subject focus appropriately
DYNAMICS	3	*made a 'compelling' (empathetic) argument*
	3	*made a 'professional' (useful) contribution*
	2	met development guidelines/followed a process
	3	ensured comprehensive review of sources
	3	appreciated the likely views of other consumers
DISCOVERY	3	*made 'interesting' connections to new ideas*
	1	*made a uniquely provocative 'product'*
	3	met 'output' goals/aims as specified
	3	ensured completeness of 'story' related
	2	appreciated the project's relevance presonally

Leader Notes:

The ways that you used color to make your points was quite clever. I was really impressed with the photo you added because it helped me to understand what you were hoping to communicate – and did so very well! Good job.

Figure 5. PAL Scoring Example for Assessment of a Derivative Artifact (A2)

Table 3. PAL dimensions and factors for effective and affective evaluation of A1 and assessment of A2

Artifact	Dimension	Aspects
A1 (Evaluation)	TIME	1. made a reasonable connection to PLACE
		2. made a reasonable connection to PERSON
		3. took creation date/period into account
		4. considered context of publication/release date
		5. appreciated the age/experience of the producer
	PLACE	1. made a reasonable connection to TIME
		2. made a reasonable connection to PERSON
		3. took production circumstance(s) into account
		4. considered context of artifact (re-)location
		5. appreciated the influence of the local culture
	PERSON	1. made a reasonable connection to TIME
		2. made a reasonable connection to PLACE
		3. took the producer's perspective into account
		4. considered limits/opportunities of the work
		5. appreciated the 'history' of the actual object
A2 (Assessment)	MECHANICS	1. made a 'sensibly-supported' claim/thesis
		2. made an aesthetically-interesting work
		3. met deliverable schedule(s) in a timely fashion
		4. ensured accurate representation of content
		5. attended to the subject focus appropriately
	DYNAMICS	1. made a 'compelling' (empathetic) argument
		2. made a 'professional' (useful) contribution
		3. met development guidelines/followed a process
		4. ensured comprehensive review of sources
		5. appreciated the likely views of other consumers
	DISCOVERY	1. made 'interesting' connections to new ideas
		2. made a uniquely provocative 'product'
		3. met 'output' goals/aims as specified
		4. ensured completeness of 'story' related
		5. appreciated the project's relevance personally

Summary and Conclusions

Practically attending to 'the basics' of learning in a digital age, the three axes of the PAL model define a common playing field to 'reel in' exploding objectives that challenge today's teachers. A call to action for lifelong learners, PAL (the Provocative Artifacts for Learning framework) literally aims to help novices to experts see how 'it's all hitched together' as John Muir described our diverse universe. This new framework for thinking about existing works and the resulting works catalyzed by that examination, offers a way for today's learners to translate data and information into knowledge and understanding with renewed interest and to express their unique views with an enduring passion. As Scherry Turkle eloquently surmised in *Evocative Objects,* "We think with the objects we love; we love the objects we think with" (2011, p. 5).

Within the PAL model, decision-making happens in that space between evaluation of the original artifact A1 as a consumer, and assessment of the conceptualization and production of the related derivative work. Encompassing both the affordances of technology applications and opportunities for educational practice, PAL enables learners to express their own ways of making sense of the content and context of the provocative artifact as it might apply in their respective, unique time and place. Making the most of that 'kairotic state', educators can cultivate 'information artisans' (IAs) who appreciate and crave the joy of discovery that leads to better choices. In today's rapidly changing techno-culture, this new approach to evaluation gives traditional topics a new relevancy. In turn, practicing the agnostic skills of judging the influencing (often hidden) aspects in both directions allows learners to experience iterative knowledge discovery supported by metacognition. Giving agency to students empowers them to appreciate and personalize new knowledge that can lead to transfer. This 'next-generation literacy' – by design – likely will be able to transfer across future domains that we cannot even imagine now.

In *When We Are No More,* Abby Rumsey (2016) states that:

> Like muscles, memories weaken with time when they are not used. Just as in the art of packing, in which what we leave out is as important as what we put in the bag, so too does the art of memory rely on the art of forgetting. What this means for the digital age is that data is not knowledge, and data storage is not memory. (Chapter 1, What is Memory, ¶ 2)

I add that having information does not ensure understanding. How we interject our analog world (through human beings) into the increasingly invasive digital realm, will determine the ability of future generations to make sense of whatever we leave behind for them to discover. PAL seeks to help educators find the right balance to perpetuate an integrated culture (milieu) in which humans maintain control over decision-making processes, individually and for the collective good.

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