Professional Learning Frameworks:
A short review of the literature

An Evidence-based Framework for Professional Learning

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June 2016

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This review is a short synthesis of some of the literature around learning in adulthood, professional learning, professional learning frameworks, and models of professional learning frameworks. Its primary purpose is to inform the development of an interview protocol for the exploration of building a professional learning framework with a secondary purpose of providing richer shared language and understanding around some of the central constructs of a professional learning framework for the informal science education community and other informal learning environments.

Learning
In order to design an effective learning experience of any kind for adults, it is important to first understand how adults learn. There has been much discussion on how adult learners bring unique circumstances to the educational experience over the last few decades. As early as 1938 John Dewey was exploring the role that experience played in how adults learned and continues to be a central idea in more modern adult education literature (Merriam & Brocket 1997).

In general, learning is a biological process in which the neurons in the brain receive stimuli containing information which in turn is encoded, stored, and retrieved. The neurons in the nervous system release neurotransmitter chemicals which bridge the gap between neurons as an electrical signal, generated by some type of stimulus, is transferred from one neuron to another. The neurons then reabsorb the neurotransmitters to be reused to transmit new signals. There are a number of different neurotransmitters, each of which controls the activity of the neurons in different ways (Merriam, 2001; Wlodkowski, 2008).

When we learn anything new, connections are made, containing the information that was learned, between some of the neurons in the brain. Therefore, we can think of learning as a neurological change in the neural networks in the brain, with specific pieces of information being cached in different areas of the brain. (Wlodkowski, 2008). The various stimuli, including emotions, which a person experiences throughout his or her lifetime, and especially those experienced in childhood, result in continual growth or reorganization of the brain. And while at one time it was thought that the adult brain was considered to be rather static and inflexible, newer research has found the adult brain continues to change and reorganize in response to stimuli. Molecular changes in the hippocampus region of the brain are the triggers that result in memory, although memories are thought to be stored in another region of the brain (Merriam, 2001)[those being the frontal, parietal, and temporal lobes].

Learning, then, can be thought of as a type of biochemical change that occurs in the learner and we normally assume the change is positive and permanent, at least until new knowledge replaces what was just acquired. The change could be in the cognitive, affective, or psychomotor domains, or any combination of the three. Motivation to learn is diverse, but two major motivators are seeking knowledge and seeking to understand with the

former being information, and the second being integration of the information(Heimlich & Norland 1994). Motivation can be defined as being a "natural human process of directing energy to accomplish a goal" and the level of motivation to learn, in which learners find meaning and value in the learning, usually correlates with the level of learning that occurs (Wlodkowski, 2008).

Learning is also a social experience, with the ability to share, question, and challenge others being important aspects of the process. Discussing the issues at hand with others can result in a better understanding and deeper personal growth for the professional (Dadds, 1997). An individual builds a robust knowledge and understandings through social construction using talk, activity, and interaction (Vygotsky, 1978).

In essence, learning is about taking in data, organizing or framing the information, making meaning of the data, and then using the data to make a decision, to act, or to feel (Heimlich, & Ardoin, 2015). It is generally accepted that learning is life-long, life-wide, and life-deep (Banks, Au, Ball, Bell & Gorden, 2007; Feder Shouse, Lewenstein, & Bell, 2009). Life-long refers to the humanness of learning as a process that happens at all life ages and stages, and in all contexts. Knowles (1970, 1982), in discussing adult learning, acknowledges that the learning process itself is not different, but the context of learning is different—the older the individual, the more life experiences the individual has acquired, what is learned is more directly connected to immediate application, and learning is closely tied to the social role at the time. Adult learners also are more self-directed and are empowered to have a greater degree of control over their learning experiences than do younger learners (Clardy, 2005; Kenner & Weinerman, 2011). Adult learners learn what they want to know – what they perceive to be as meaningful to them or the situation they are in at this point in time (Illeris, 2002).

Life-wide learning suggests that what one learns is cumulative across many experiences and occasions (Martin, 2004). Another view of life-wide learning is that individuals intentionally engage in different experiences and that all experiences can be considered learning (Malcolm, Hodkinson & Colley, 2003) which can challenge the default assumption of learning only as a cognitive act. Heimlich (2016) suggests that learning refers to human qualities of what an individual experiences through all senses, and then how those experiences shape the individual. Life deep learning recognizes how individuals can choose to "dig into" a topic, an experience, an idea, a hobby and spend significant time or thought on that experience (Tough, 1978). Livingstone (1999) found that most adults spend around 15 hours per week engaged in informal learning and that much of that was centered around volunteering, work, household learning (gardening, repairs, cooking), and general interest such as hobbies. Life-deep also acknowledges that all learning is influenced by one's culture, values, beliefs, and ideologies (Bell et al., 2009).

A critical understanding of learning includes knowing about learning processes, learning environments, teaching, sociocultural processes, and all the other factors contributing to learning (Bransford, Brown & Cocking, 2000). The nature of the learners, the nature of the context, and the nature of the content interact to define the learning opportunity (Cranton, 2003). This is especially true for understanding who the professional learner is, when in their career and where in the trajectory the learning is to happen, and why the professional would need to or seek a professional learning opportunity.

Traditional forms of professional learning

Much professional learning continues to focus on training techniques that often don't transfer into workplace performance/improvement. In traditional professional development, one of the most common formats is the workshop, which occurs outside the workplace at a specific, scheduled time and is facilitated by perceived experts in the field. Other types of professional development that have these same basic features are conferences, courses, and institutes (Garet, Porter, Birman & Yoon, 2001). Dadds (2007) calls this type of professional development program the "empty vessel model". These behaviorist models are based on outside authorities making decisions about what information should be included in professional development rather than giving voice to those who will be engaging in the professional development program. This structure of professional development often results in professionals feeling as if their needs and ideas are not respected and they become disenfranchised with the entire professional development process. This, in turn, allows the outside authorities to set the standards and expectations for the program, even though outsiders often do not have all the answers. Therefore, although outsiders' ideas should be taken into consideration when appropriate, they should serve only as supportive resources to what the experienced professional brings to the program.

Presently much professional development also does not acknowledge that moment-to-moment learning which professionals actively acquire through a broad range of experiences (Webster-Wright, 2009). Adult learners do not come into a professional development program as empty vessels, but instead have their own individual insights, perceptions, and experiences to bring to the table (Dadds, 2007). While we recognize the need for professionals to be updated with regard to professional standards, future professional learning should also focus on a more holistic model in which not only formalized professional development courses are considered to be important, but also recognizes the importance of the learning professionals encounter in the course of life experiences. By taking these steps, professional development would result in a more authentic professional learning experience and perhaps should be termed as professional learning rather than professional development (Webster-Wright, 2009; Corcoran, 1995).

Although adult learners have found life experiences to be useful in navigating many aspects of their daily lives, these experiences are not always sufficient in helping them in their professional lives. Being aware of this gap in their knowledge and skill set helps adults acknowledge the need for professional learning experiences. Framing this need in terms of how the adult learner can see the benefits that will result from the new learning strategies is a key requirement of adult learning (Kenner & Weinerman, 2011). The more coherence that the professional can perceive in the content of the professional development, the more likely the professional is to embrace and institute any changes in behaviors and activity presented in the session (Penuel, Fishman, Yamaguchi, & Gallagher, 2007).

Because workshops, etc., are often a one-off program, with no follow-up sessions, they are criticized as being less than effective because of insufficient time for useful content and

activities to be studied, resulting in little or no change in professional strategies or knowledge (Garet et. al., 2001). By giving the adult learner time for repetition in learning and practicing new strategies, the internal competition between the daily life experiences learning strategies that have worked for so long for the adult learner and the new strategies that are more appropriate for the professional life of the adult learner are minimized (Kenner & Weinerman, 2011).

Although some well-planned professional development workshops can be effective if the focus is on not just knowledge acquisition but also practical application, traditionally many workshops have not met this criteria and are not considered by many to be effective professional development forms (Guskey & Yoo, 2009). This lack of efficacy led to exploring alternative forms of professional development, especially those that occur in the workplace during regular work hours. Having on-site professional development sessions provide a more contextual experience and often demonstrates more meaningful professional techniques and strategies that may be retained longer and utilized more than those which are presented during a traditional professional development program. This results in a professional development experience that may be more responsive to the professional's needs and goals (Garet et. al., 2001).

Models of professional learning
The preponderance of the literature regarding professional development explores professional development in the field of education. However, even up until the beginning of the 21st century, there had been little systematic research probing efficacy of professional development programs in the teaching field. And even less research had been conducted on the effects of alternative forms to the traditional professional development models that were normally used (Garet et. al., 2001). Fundamentally, any type of educational or training program should be based on the needs of the learner. The needs can be related to professional, personal, religious, social, cultural or other intrinsic individual needs and serve as a motivator to engage in learning (Seaman, Fellenz 1989, Caffarella & Zinn, 1999).

A number of models for effective professional learning have recently been developed, based on the analysis of the research that has been done in this field. Kennedy (2005) describes eight professional development models.
1. The Award-bearing Model: two-edged sword due to the emphasis on a quality program that is validated by an institution such as a university, this also means the content is controlled by outside experts.
2. The Deficit Model: addresses perceived weaknesses in the professional and may be used in the context of performance management with not always clear expectations set for improved and/or competent performance.
3. The Cascade Model: a small number of professionals attend the professional development session and then are responsible for disseminating the session content to other professionals. Usually focuses on skills and knowledge, but not values.
4. The Standards-based Model: focuses on acquiring knowledge and skills which will result in meeting specified outcomes and usually ignoring any type of collegiate learning/sharing.

5. The Coaching/Mentoring Model: defined by an important one-on-one relationship between two professionals, often with one being a novice and the other an expert, although some are based on relatively equal professional experience.
6. The Community of Practice Model: similar to the coaching/mentoring model described above, but usually includes groups of professionals rather than pairs. Depending on the individual, this could result in a very proactive or a passive experience.
7. The Action Research Model: participants themselves research their understanding of the professional situation in question with a view to improving it, giving the professionals more control and direction to their professional development programs.
8. The Transformative Model: relies on a number of different aspects of the previous seven models that support a transformative agenda.

Other professional development models have some components of those described by Kennedy. A model developed by Glaser and Hannafin (2006) created teaching communities in schools. These communities consisted of expert teachers who served as mentors and advisors to novice teachers by sharing with the novices the strategies and techniques they found to be effective through their years of experience. This model was termed the "collaborative apprenticeship" model, and was composed of four phases. During the introduction phase, the expert teacher would present and model his/her strategies to the novice teacher, then both would discuss and reflect on the experience. This was followed by the developmental phase in which the expert teacher actively helps the novice teacher acquire skills and strategies by providing coaching and support while the two collaboratively develop and implement learning activities for the novice. Through the proficient phase, the expert teacher will identify areas of improvement and exploration, the novice will exhibit increased understanding of best practices by developing learning activities independently, and then the two will share the experience with their peers. Finally, during the mastery phase the expert teacher will observe and participate in the methods designed during the proficient phase while the novice teacher will share, promote, and model the best practices and strategies learned during the professional learning sessions, resulting in the novice teacher transitioning into the expert teacher position. Throughout this entire process, reciprocal interactions that nurture the mutual relationship between the two teachers are one important aspect to the efficacy of the program. While this model was developed for a school setting, it is obvious that the expert/novice reciprocal interactions could easily exist in other professional settings.

Similar alternative models of professional development some schools are implementing include mentoring, peer observation, and coaching of beginning teachers by experienced teachers and local support groups, usually by subject matter, allowing teachers to share and network with other teachers. Since these types of professional development usually take place within the school day, participants may engage in these activities for a longer time period than would be expected with traditional professional development sessions (Garet et. al., 2001). Many of the components discussed here by Garet, Porter, Birman & Yoon are similar to ones seen in the collaborative apprenticeship model above and can also be easily converted to function similarly in a different professional setting.

Sometimes the professional development model may focus on one aspect of the profession rather than in multiple aspects. This is the case in which the focus of a professional development model, designed and tested by Posnanski (2002), was to increase the feeling of self-efficacy in participating teachers. This model explored two attributes of self-efficacy: the expectancy that it is possible to develop and implement a desired behavior and the belief that the behavior will lead to the desired outcome. The construct was that if teachers learned subject matter using the same strategies and methods as students did, they would have an increased understanding of both the subject matter content and confidence in using more innovative learning strategies. The first step in this process is to identify, evaluate, and challenge existing self-efficacy beliefs before acquiring the content and pedagogical knowledge in the program. Further participation would require participants to collaborate as the program progressed and to commit to a long-term association with the program, with the end result being the assimilation of new sources of information, resulting in increased feelings of self-efficacy in their profession. This reflects the Garet, Porter, Birman & Yoon (2001) conclusion that good reform professional development activities should result in increasing the teacher's knowledge and skills in their content area, which in turn should lead to change in teaching practice. As with the other educational professional development programs that were designed for educators, this could be easily modified for other professionals.

Components of professional learning frameworks
The question of what constitutes a professional learning framework does not have a simple, cohesive answer. The literature provides recommendations, but without great consistency in how the ideas of a professional learning framework merge. For example, collaborative conversations are important for adult learners and in her study, Lind (2007) found conversations were one of the most important components of professional development. This finding was reflected in the analysis of the efficacy of many professional development programs (Glazer, Hannafin, 2006; Garet et. al., 2001; Heller, et. al., 2012; Mayer, Mitchell, Macdonald & Bell, 2004). Other factors to include in looking at building a framework: duration; time span; role of colleagues/professional community; appropriate mix of foci; active learning; coherence; and local supports and barrier (Penuel et al., 2007). Finally, person-to-person professional development has shown to be more engaging and effective than professional development accessed via an online or printed source.

Data from a study done by Garet et. al. (2001) suggested there are three key structural features of good professional development practices: form, duration, and collective participation, as well as the core features: content focus, active learning opportunities, and coherence. The preferred professional development form would be one or more types of alternative forms rather than traditional workshops, conferences, etc. Duration is defined by the length of time the professional development activities occur and can be divided into the number of contact hours spent in a professional development activity and the span or period of time, usually measured in days, weeks, and months. Research has found that both of these duration dimensions are of equal importance in the overall quality of professional development.

Little (1993) suggested six design principles for professional development, adapted here to reflect museum context rather than schooling contexts:

1. Offer meaningful intellectual, social, and emotional engagement with ideas, materials, and colleagues
2. Take explicit account of the contexts of the work and the experience of the individuals
3. Offer support for informed dissent
4. Place practice in the larger contexts of institutional practice and the mission
5. Prepares individuals to employ the techniques and perspectives of preferred practices
6. Ensure bureaucratic restraint and a balance between interests of individuals and institutions

Coming from a very different perspective, Guskey (1999) noted five levels of participant outcomes that can inform the evaluation of professional learning, but also can inform the framework for the learning. These levels start with reactions of the participants to the program, then participants' learning leading to organization support and change (was the learning for an organization or for the individual) and of course the use of the participants' new knowledge and skills and ultimately the fifth level, the outcomes of the audiences of the individual receiving the training.

Sandholtz (2002) suggests there should be opportunity and time built in to the overall program that allows participants to "explore, reflect, collaborate with peers, work on authentic learning tasks, and engage in hands-on active learning". The most effective professional learning is that which provides participants with information that is most relevant to them and their professional needs rather than general information on topics in their field. Knight (2006) notes that both vertical (acquisition of new concepts and strategies) and horizontal (broadening the range of the use of the concepts and strategies) learning should be involved in professional development to guard against it becoming stale or obsolete. It was also discovered that longer professional development sessions did not correspond with more dramatic results. Instead, having follow-up professional development sessions seemed to help reinforce the initial participant responses which could ultimately lead to more substantial changes in knowledge and behaviors and result in a bigger "buy-in" from participants (Garet et. al., 2001).

One topic that has not been discussed in many professional development programs but now plays a major role in many professions is in the field of technology. In today's world of computer programs, emails, and the internet, being fluent and comfortable with technology is very important to be successful in one's professional role. A reform professional development program in technology must include enough duration and content to carry the participant from the initial orientation stage, through the adoption, evaluate, and innovation stages to the final institutionalization stage, at which point the strategies introduced in the professional development program become common practice in the participants' professional world (Watson, 2001). While this may not be a major theme in professional development programs, in view of the rapid new technological developments frequently occurring this could be a valuable addition to some programs.

There were many studies that suggest different factors that should be considered. Across these, there were some consistent themes that emerged:

- Traditional workshops, institutes, etc., are usually not the most effective forms of professional development
- Offering professional development sessions in the context of the workplace often is more effective than having sessions off-site
- Person-to-person professional development is more effective than printed or online sources
- Effective professional development should be based on what the participants need and want rather than what an administrator or outside expert determines is needed
- Collaboration is an important aspect of most forms of professional development, allowing participants to share and reflect on their experiences
- Professional development programs that span a longer time period allow participants to have more time to explore and analyze new strategies and techniques
- Care must be taken to guard against professional development from becoming stale or obsolete

Barriers to professional learning
Many studies have explored the barriers to professional development and professional learning for educators. Knowing the probable and potential barriers will allow the professional learning framework to be constructed as to minimize or mediate these barriers.

Related specifically to inquiry, many teachers in public schools have little knowledge of what inquiry is and are reluctant to implement teaching strategies to meet changing standards (Johnson, 2006). Berns & Swanson (2000) found that inadequate preservice preparation in content, scientific inquiry, and appropriate pedagogical skills had teachers entering schools without proper preparation for engaging in the complex processes required for inquiry-based education. Further, Berns and Swanson found that educators seemed to be prepared in either the content or the pedagogical content but rarely in both. In general, the literature suggests inquiry-based instruction demands a high level of pedagogical content knowledge (Keys & Bryan, 2000).

There are three structural dimensions of barriers teachers face while implementing reform efforts: technical, political, and cultural (Anderson, 1996). These dimensions of reform implementation also transfer to barrier in professional development as noted by Penuel, Fishman, Yamaguchi and Gallagher (2007) in their use of Anderson's structure in an examination of teacher professional development. The technical barrier includes content knowledge, pedagogical knowledge, and the educators' ability to teach constructively and implement reform. The political dimension's primary barrier is a lack of school or district level leadership and support but also includes lack of financial or programmatic support for professional development and any lack of resources, equipment, consumables, or materials. The cultural dimension relates to existing beliefs and values regarding teaching and in this domain, teacher beliefs are a key factor in determining instructional practices.

Penuel, Fishman, Yamaguchi & Gallagher (2007) noted local supports and barriers as being very closely aligned and include knowledge and frames for interpreting policies, schedules, budgets, time for planning and reflection along with school-specific philosophies and initiatives competing for attention in schools. Other structural barriers identified in different studies include inadequate in-service (professional development) and because of lack of adequate pre-service training (Supovitz & Turner, 2000; Corcoran, 1995; Goktas, Yildirim & Yildirim, 2009).

Many studies identified specific barriers that function more at the individual than the structural level. These include time to engage, time for planning, instruction, and collaboration, the educators' beliefs, assessment, and choice in collaboration (Lind, 2007; Penuel et al., 2007; Klingner, 2004). Johnson (2006) identified more specific barriers for and thus need for professional learning in instructional skills, management issues, and grading issues.

Watson, (2001) noted that professional development programs must include enough duration and content to carry the participant from the initial orientation stage, through the adoption, evaluate, and innovation stages to the final institutionalization stage. The lack of local leadership, resources, collaboration support, and limited in-service challenge the ability of a professional development program to meet such duration and content.

There is across the literature a concern that limited training for educators at the secondary level leads to a need for in-service professional learning (Goktas, et. al., 2009; Darling-Hammond, 1998). Some of these concerns are highly transferrable to the museum community, and especially the education, interpretation, visitor services, and communications functions of the institutions. Confounding the limited training is the "preparation ethic" which Anderson and Helms (2001) identified and defined as the educator being focused deeply on content to ensure the student will be prepared for the next level, grade, course, etc. and therefore sacrifices pedagogical approaches to cover more content. Lind (2007) also noted the passion the learners had toward their work was both a driving force behind their participation in the professional development but that passion pulled against their being fully present when gone for extended periods of time from their work.

Similarly, it is well understood there is a reluctance to relinquish safe and familiar for new and uncertain practices (Gess-Newsome, 2001). Further, changing instructional practices is not easily accomplished or conflict free, whether conflict is internal or external (Johnson, 2006).

Knowing the probable and potential barriers will allow the professional learning framework to be constructed as to minimize or mediate these barriers.

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