ETEC 565A - Assignment #2 – CYOA

Team-based Analytics for Informal Learning (TAIL)

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Introduction

In a software driven world, the pace of change, empowered, knowledge-worker based teams and flatter organizational structures push us toward a learning analytics ecosystem that focuses on a team-based model that embraces informal learning. To simplify, for the remainder of this paper it will be referenced as team-based analytics for informal learning (TAIL). In TAIL, we recognize that "Learning is a mechanism for people, groups, industries, and society to benefit/gain knowledge from past experiences, adapt to the context of any given situation, and to facilitate change." (Aramo-Immoenen et al., 2015, pg.584). And more specifically, informal learning occurs when doing anything related to the work that the teams are performing, often going unnoticed (Denneriein et al, 2015; Aramo-Immoenen et al., 2015). Overlooking informal learning can negatively impact an organization as innovative and disruptive products no longer take years to bring to market (Blank, 2019) and learning has emerged as a critical success and survival mechanism as no one wants to get "Ubered" (Carmody, 2014).

This exploration will be illustrative and valuable "as we are currently immersed in a technology age, a realization is emerging that learning is continuously happening beyond formal training environments and that experiential and informal methods should be considered in solutions with greater weight (Rosenheck, 2013)" (Hruska et al, 2014, pg. 3). And generally, in this technology age we're interested in software development as "more and more businesses and industries are being run on software and delivered as online services" (Andreessen, 2011). In essence, most organizations will find that success hinges on their software development skills. And to succeed, they are going to need an effective team as it "…increases the probability of achieving set results for any project, process, product or service, including learning" (Conde et al, 2018, pg.552).

To build TAIL, we would use xAPI, the experience API, and a supporting Learning Record Store (LRS). “The xAPI specification describes packaging and transmission of learner actions called ‘Activity Statements’ between any tool and a learning record store (LRS), the database model that validates and stores activity statements” (Kevan & Ryan, 2016, pg. 144). A temptation to jump in and start building a solution may emerge as it all seems straightforward as any tool can be integrated. Such a perception is reinforced in blog posts (Alford, 2017; Blake-Plock, 2015), articles (Roth & Keller, 2019; Freifeld, 2017) and reference guides (Roth, n.d.). However, one has to wonder if this simplistic and idyllic view of technology focused integrations, combined with past LMS centric views of formal-learning leads us to underestimate the complexity and depth of creating TAIL. While not simple, formal learning is familiar to most and as a result terms such as teacher, student, class, assessment, and success are known and generally understood. In contrast, informal learning combined with team-based operating models is not as well researched or understood. This gap in research and execution provides opportunity for novel research and significant impact within an organization.

Recognizing Context and Complexity

The use of xAPI and an LRS may seem straight-forward from the outside. Find data sources, develop an integration to get activities into the LRS, analyze, add some visualizations and voila – learning success! However, there is significant complexity and effort needed to think about the data selected, how will it be used and how to align it with organizational goals. For instance, it may seem that to support informal learning in a software driven organization we could simply integrate common team-oriented software development tools such as Slack, GitHub and Jenkins. However, such an approach is an oversimplification, insufficient and would be ineffective. TAIL is intended to highlight the depth and thoughtfulness needed to understand

how teams learn, operate and lead to the identification of interventions that help those teams succeed.

Approach

The following dimensions of research inform this report and in turn shape recommendations for learning analysis considerations and follow on interventions:

- **Informal learning**: Informal learning occurs frequently within organizations and is often overlooked (Eraut, 2004; Aramo-Immoenen et al., 2015).
- **Social learning analytics**: Consideration of social learning analytics (Ferguson & Buckingham Shum, 2012) provides a foundation for evaluating team-based interactions.
- **Teams**: Recognition of team competencies (McIntyre & Dickinson, 1997; Vivian, Falkner, Falkner, & Tarmazdi 2016), team models (Kniberg & Ivarsson, 2012), and development stages (Tuckman & Jensen, 1977).
- **Definitions of success**: To determine when and what interventions to introduce, we need to have an updated view on success and failure (Kniberg & Ivarsson, 2012; Choi, 2014) and available innovation timelines (Blank, 2019; Carmody, 2014).
- **Digital tools**: Building on the insights from the previous dimensions, recognize and reconcile the capabilities and information from various digital tools into learning experiences.

Informal Learning

Focusing on informal learning presents challenges as it encompasses

"…all that is related to the work process itself, including the carrying out of the work. During a work process, new things are learned that affect the work processes in one way

> or another, either directly or indirectly. Informal learning is often not noticed or realized" (Aramo-Immoenen et al., 2015, pg.585).

During a work day, there are an enormous number of interactions that could be captured, analyzed and visualized. Simply and bluntly put, the vast majority of an employee's time is spent informally learning in team environments. Yet, analysis and support for informal learning lacks integrated instrumentation, analysis and interventions. And, while Big Data can process enormous volumes of data, we still need to be thoughtful about which data we want to capture, what it could possibly tell us and how we could use it.

Social Learning Analytics

A team is a social construct bringing together a group of people working toward a common goal (Dickinson & McIntyre, 1997). There's no getting around the fact that members of a team need to have social interactions.

> "As groups engage in joint activities, their success is related to a combination of individual knowledge and skills, environment, use of tools, and ability to work together. Understanding learning in these settings requires us to pay attention to group processes of knowledge construction – how sets of people learn together using tools in different settings. The focus must be not only on learners, but also on their tools and contexts" (Ferguson & Buckingham Shum, 2012, pg.23).

Ferguson and Buckingham Shum (2012) guide us to consider these social learning analytics from five perspectives including: social network, discourse, content, disposition, context. The following table details each perspective.

Category	Description

Social Network	Looking at the interactions between actors (people and/or things). Considers roles, connections, strength, networks and how they relate to learning.
Discourse	Focuses on the language used in the interactions. Analyzing the dialogue can help us understand how actors engage, share ideas, problem solve and explore.
Content	Examines, indexes and filters content. Many media artifacts are available within a social network, and this perspective focuses on helping to find valuable content.
Disposition	Consider the learner's relationships, strategic awareness, resilience, creativity, meaning making, critical curiosity and openness to changing and learning.
Context	Consider social interactions in light of when and where it happens. The interaction could occur between peers, within a small team, or as part of a larger community of practice.

Table 1 Overview of the categories of Social Learning Analytics (Ferguson & Buckingham Shum, 2012)

While these categories provide a solid foundation, further specificity and contextualization is needed and provided through team competencies, team structures and roles, measures of success, and digital tools.

Team Competencies

Whether we consider sport teams, academic teams or teams within a corporate setting – we don't have to look long or hard to see that some teams perform better than others. Being able to see that there is a difference, doesn't necessarily make it easy to discern *why* there is a

difference. “The development of teamwork leaves evidence of three types: individual (participation, cooperation, monitoring, leadership, efficiency, etc.), group (mission and objectives, standards, map of responsibilities, etc.) and results (Fidalgo-Blanco et al., 2015, pg. 150). Teamwork competencies as introduced by McIntyre and Dickinson (1997) and further elaborated by Vivian, Falkner, Falkner, & Tarmazdi (2016) are aligned with such evidence and are summarized in the following table.

Competency	Description
Team Orientation	Focuses on skills and mindset as it relates to the interactions within the team, language used in communications, the cohesiveness of the team, team norms, emotions and humour.
Team Leadership	This does not and should not be seen as having appointed a single, individual leader. Instead, consider how group members exhibit leadership. Leadership supports alignment on direction, structure, and responsibilities.
Communication	Team members exchange information following team norms (terminology, timing, tools and approach) in pursuit of team goals.
Monitoring	The team observes progress, behaviors and activities. They care enough to pay attention.
Feedback	To learn the team must embrace feedback. This means that they are comfortable receiving feedback, giving feedback and seek out opportunities to get feedback.
Backup Behavior	The team supports one another in getting work done. They find opportunities to help others or to ask for assistance.

Coordination	The team aligns on activities, deadlines and deliverables.

Table 2 Summary of team competencies as introduced by McIntyre and Dickinson (1997) and further elaborated by Vivian, Falkner, Falkner, & Tarmazdi (2016).

Gaining insights of a team's competency levels helps us to align outcomes with performance. With such a mapping in place, we can introduce better interventions for under-performing teams.

Team Structures, Roles and Processes

Typical corporate software development efforts are too complex for an individual to complete and require team-based collaboration. Further, even teams don't operate independently; teams need to coordinate and collaborate. Typically, such collaboration (teams and teams of teams) is influenced by Lean, DevOps and Agile. Various scaling models and approaches have surfaced to help teams work together. One such approach is based on Spotify's model which is known as "Tribes, Squads, Chapters & Guilds" (Kniberg & Ivarsson, 2012). This matrixed teaming model is described in the following table.

Team Construct	Description
Squad	This is an Agile team; long-lived, co-located, self-managing and working toward a shared mission. Working with the team are individuals in the roles of Product Owner and Coach. The size of a Squad generally conforms to the idea of a "two-pizza" sized team (Hern, 2018) – that is, if you were to order two pizzas, it would feed everyone on the team.
Tribe	This is a group of Squads working toward a shared goal that requires collaboration and coordination. Typically, a tribe would have around

	100 people – taking inspiration from Dunbar's Number (Dunbar, 1998). This is a team of teams.
Chapter	A Chapter is a local grouping of folks with similar skills working in the same area. A Chapter would align with a specific Guild.
Guild	You can think of a Guild as a community of practice or a community of interest. A Guild pulls members from across the organization. Anyone can join any one of the Guilds.

Table 3 Overview of Spotify model (Kniberg & Ivarsson, 2012)

Generally, an individual would belong to a team at each of these levels, that is, a person would belong to a Squad, a Tribe, a Chapter and a Guild. As a result, learning opportunities could occur based on experiences or interactions within the scope of any of these teams. Further, we should expect to see learning propagate across these different team structures. That is, if a lesson is learned within a Squad, it should be shared with others either via individual, Squad, Chapter or Guild interactions.

Team interactions and learning experiences are further complicated due to variations in team lifespan and membership. The ideal is to have long formed teams, but the duration of team existence and membership varies. Tuckman's team development stages: Forming, Storming, Norming and Performing (Tuckman & Jensen, 1977) would provide a mechanism to evaluate learning interactions in light of these complications.

Measures of Success

A goal with learning analytics is to analyze and interpret data to help the learner through interventions. This focus on outcomes shapes how we analyze and interpret data. If we lack clarity on success, then our data interpretation will lead to inappropriate interventions. A

reorientation around success has found the software industry focusing on experimentation and recognizing that we need to learn from feedback. For instance, "At Spotify, failure is cause for celebration, because it's seen as an opportunity for growth" (Choi, 2014). In doing so, we may find that our hypothesis is correct and further investment is needed. Or, we may find that we do not have the correct hypothesis, that our product idea has failed and needs to be adjusted or abandoned. Good teams focus on learning quickly and efficiently through running experiments, testing ideas and focusing on evidence. The days of long timelines, a single acknowledgement of feedback at project completion and operating on theory and assumptions are long past.

When interpreting informal learning interactions, we need to be mindful of these views and values. A message between colleagues that discusses a test or feature that has failed is not a negative interaction. Teammates discussing failure and trying to figure out how to adjust is a valuable learning interaction. Rather than introducing an intervention to stop such a scenario, we'd seek opportunities to encourage experimentation, get feedback and make adjustments. An avenue of analysis and investigation would be determining frequency of failure themed discussions, experimentation and improving experiments. An absence of such discussions would highlight the need for interventions.

Digital Tools

Software development requires digital tools. Some of these tools are focused on specific technical aspects, some are focused on communication and social networking, and some bring both together. These tools provide us with a digital footprint that we can track and analyze. Common tools used and worthy of consideration include Slack, GitHub and Jenkins. Such tools have many events that occur throughout the workday. Some of these events could be valuable for providing insights into occurrences of informal learning. A challenge is that there are many types

of interactions and we need to figure out which add value and how they relate to the many dimensions that we've discussed previously including social learning analytics, team competencies and team structures, roles and processes.

The following tables summarize each of these tool's (Slack, GitHub, and Jenkins), interactions and potential avenues of informal learning evidence and analysis.

Slack Interactions	Informal Learning Considerations	Analysis Approaches
Direct messages between individuals	• Team membership • Content of message	• Messaging via Slack can be a rich source of informal learning activities. Analysis should include consideration of social learning analytics, team competencies and team membership. • Natural language processing supports investigation of discourse, content, disposition and context. • Establish connections between Slack messages and activities / interactions from GitHub and Jenkins.
Messages within a team channel	• Team membership • Content of message	
File sharing	• File type • Content of the file • Associated messages	• Focus on content analysis to generate indices, recommendations and relationships. Related discussions can also highlight the value or impact of the file.

Table 4 Slack Informal Learning Interactions

<table>
<tr><th>GitHub Interactions</th><th>Informal Learning Considerations</th><th>Analysis Approaches</th></tr>
<tr><td>Pull Request / Peer Review</td><td>• Team membership
• Review comments
• Team Competency</td><td rowspan="6">• We can analyze the interaction looking at the team competencies as a lens on learning.
• Team membership also becomes an interesting avenue of exploration. At a minimum, there’s an expectation of Squad member participation. However, analysis should look at impact of this activity as it relates to Tribe, Chapter and Guilds. Does the learning from this interaction get propagated to a broader audience based on team memberships and structures?
• Roles in an interaction also are important. For instance:
o Reviewee: Learns via the feedback provided by the reviewer.
o Reviewer: Learn from the solution itself (new, alternate approach), thinking about better ways to solve the</td></tr>
<tr><td>Check-in Comment</td><td>• Team membership
• Review comments
• Team Competency</td></tr>
<tr><td>Code Comparison</td><td>• Code
• Associated Messages (Slack)</td></tr>
<tr><td>Wiki Contribution</td><td>• Activity
• Wiki content</td></tr>
<tr><td>Create a defect</td><td>• Activity
• Defect description</td></tr>
<tr><td>Address a defect</td><td>• Activity
• Check-in comment
• Comments in closing defect
• Associated pull-request</td></tr>
</table>

Refactor Code	• Detected via check-in comment	problem, or from trying to formulate and share feedback (perhaps with guidance from a mentor). Further, a reviewer could learn from other reviewers that are participating in the review. • Natural language processing assists with social learning analytics as comments, posts, and documentation are considered. Network analysis could also highlight relationships between mentor/mentee. • Seek connections to related messages in Slack.
Create a unit test	• Detected via folder structure • Check in comment	
Move a card on a Kanban board	• Activity and the state of the card.	
Create / Update Documentation	• Activity	
Create / Update Code Comment	• Check-in activity, Code comparison	

Table 5 GitHub Informal Learning Interactions

Jenkins Interaction	Informal Learning Interaction	Analysis Approaches
Build	• Success | Fail • Details on code changes, code coverage and who made the code changes	• Seek out alignment between Jenkins' results and activities in GitHub and Slack discussions.
Test Execution		
Static Code Analysis		

Table 6 Jenkins Informal Learning Interactions

Conclusion

Moving TAIL forward is going to be a challenge. Informal learning is more ambiguous and difficult to parse and understand than formal learning and LMS provided data. The underlying model for informal learning is context dependent and varies based on the type of work, interaction models and the activities that are instrumented and provide a digital footprint. In exploring software development in a corporate setting, we've seen complexity emerge through a variety of lenses including informal learning social learning analytics, teams, measures of success, and digital tools.

Some technical challenges are bound to arise in deploying an LRS or accessing data via web services supplied by Slack, GitHub or Jenkins. However, the true challenge will be in the thoughtful consideration of how to analyze and interpret the available data. Overcoming the challenge will be worthwhile as informal learning is such a frequent occurrence in the workplace that it cannot be ignored. Those organizations that fail to tap into this resource will disappear.

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