**IST 512: Thesis Review**

Inspiring End-user Programming Through Exposure to Multi-platform Computing and Improved Integrated Development Environments written by Dedrie Beardsley

**Introduction**

    The thesis reviewed was focused on intrinsic motivation of software developers. The main research question centered around if Integrated Development Environments (IDEs) support intrinsic motivation in developers. The research also looked at the types of developers experiencing intrinsic motivation and how can IDEs be developed to support motivation. It was written by Dedrie Beardsley under the supervision of Professor Carlos Jensen an OSU Computer Science Professor and founder of the Center for Applied Software Systems at OSU. The research was funded through Intel where Dedrie now works as an Engineering Manager.

This thesis was a little unique in that Dedrie’s degree combined the fields of Computer Science, Psychology and as a third field Psychology. So rather than the normal interdisciplinary nature of combining three unique fields this one combined two unique fields. The thesis was well written and the strengths of it will be discussed below. It was hard to find weaknesses on the first read through but upon further reading some issues were found mainly centering on the depth of research pulled from Psychology and Computer Science. This is not implying that Dedrie is not very knowledge in these areas just that more depth could have been provided on both of the fields.

**Strengths**

**Strength 1:** Knowledge of Computer Science and Psychology

    One of the major strengths of this research was a strong understanding of both Computer Science and the field of Psychology. In the field of Computer Science her research focuses on Integrated Development Environments and in the field of Psychology Intrinsic and Extrinsic Motivation. Focusing on these two particular areas was a strength of the research as they are both incredibly important and often overlooked.

    The research clearly discusses and shows an understanding of the history of software development and how the changing needs of programmers lead to bundling useful software pieces into full development suites. These came to be known as Integrated Development Environments. There are a range of IDEs that developers can choose from and developers essentially “live” inside of an IDE as they are what you write code in, use to compile code, run unit tests or launch simulators for mobile development.

    As discussed in the research Software Engineering can be tedious and full of challenges that can be discouraging for engineers to fix. It is not uncommon for an engineer to spend hours or even days solving a small bug that they may or may not have introduced. For instance, almost all software programs are built utilizing external libraries. As other developers update these libraries your software can suddenly stop working and you must spend hours or days fixing these conflicts. Because of this an understanding of motivation is important to every aspect of the software development lifecycle.

    The research chose to look at intrinsic and extrinsic motivators. In Psychology intrinsic motivation is driven by internal rewards as opposed to external factors which originate outside the individual like being paid a salary. Her knowledge of these fields is important because it allowed her to focus on research that is meaningful, has a clear purpose and has a clear problem that is being explored. Her knowledge also was important in that it allowed her to build upon past research which allowed her to not have to reinvent the wheel. For instance, she utilizes past research to define what a successful engineer looks like. This definition is that successful engineers are team players, proficient problem solvers and have an internal drive to innovate. Her knowledge of both fields allows her to make an interesting observation in that these are unexpected and that usually successful engineers are thought of as being defined by experience, depth of knowledge and detail orientation. This paradox helps to formulate her questions that this new understanding of motivation could in the development of a better IDE that supports intrinsic motivation.

**Strength 2: Research Review of Existing Literature**

    Another strength of this research was a review of existing research and theories in both disciplines. The thesis starts out building upon existing research about theories specifically related to motivating engineers. This includes research by Turley and Beiman focusing on what traits the most exceptional engineers share. Next the research looks at the student outcomes required by the The Accreditation Board for Engineering and Technology (ABET) and notes that 60% of these have a focus on motivational principles related to problem solving, analytical thinking, teamwork, communication, curiosity and life-long learning. The next strength of this thesis is she presents a contradiction in these traits and the commonly held belief that engineering success is related to experience, depth of knowledge and detail orientation.

    Having looked at literature related to motivation she then moves on to look at the history of Integrated Development Environments and early research by Osterweil proposing that these tool collections should have five properties; Capabilities spanning the entire range of activities needed to complete a software job, user friendliness, tight tool integration, internal reusability and the use of a central database. A lot has changed since then and the research then presents a thorough picture of the current state of software development and IDEs.

    Next the research looks at theories in psychology related to intrinsic and extrinsic motivation. The next major theory that is detailed is self-deterministic theory which states that intrinsic motivation comes from a high level of the three basic psychological needs of autonomy, competence and relatedness. There is a lot of research looking at motivation in software developers and the research points out its uniqueness in relying on Self-deterministic theory.

**Strength 3:** Methodology and Design

   Another major strength of this survey was the research methodology and design. The researcher developed a survey to evaluate motivation. In the thesis she mentions that there is no consistent method to evaluate motivation and also no solid methodology to measure levels of intrinsic motivation while using a software tool. The research outlines how this is important to the design and then lays out the development of a research instrument to test and measure for intrinsic motivation. The author looked at 519 papers where 22 motivators and 15 de-motivators were found in the literature which allowed the author to develop an appropriate theory of motivation and develop survey questions that had a scientific precedent. After developing a new instrument survey they then deployed this survey to 103 participants which is a fairly large survey size.

**Weakness**

For a masters level thesis I felt that this was very well put together. It may seem contradictory because my first points discuss the research depth as a strength and those are listed below as major weaknesses. This is primarily for two reasons for this contradiction. The first is that these weaknesses are not major weaknesses but minor ones that could have been further elaborated on. The second is that as I read through more times it started to become clear that even though it listed things like looking at 519 papers it really did not incorporate or elaborate on this research beyond a very shallow way.

**Weakness 1:** Depth of Psychology Research

    In this thesis the depth of the psychology research seemed a little shallow for a master’s level degree. The main concepts discussed included self-deterministic theory, intrinsic motivation and extrinsic motivation. Self-deterministic theory contains both intrinsic and extrinsic motivation so much of this research was centered upon one major psychological theory and five of its sub-theories. However, a quick search on wikipedia and a major psychology site covers almost the entire psychology based components of this paper. This sounds very critical but as stated earlier this was a well written thesis it just seemed that at the graduate level for a person focusing on psychology the discussion and entirety of the paper should have contained more depth. This also doesn’t subtract from her knowledge of these fields or the literature she looked at in the literature review.

**Weakness 2:** Depth of Computer Science Research

    The next weakness was the depth of computer science theory and research for a master’s level thesis. To be clear it was well written and there was a lot of good information but it seemed like the types of information that a well written technology journalist would provide to the general public on integrated development environments. In fact there was no chapter dedicated to past computer science theories or methodologies. There is actual substantial research in the field of Human Computer Interaction that could have been pulled into make this thesis much stronger.

**Weakness 3:** Statistical Analysis and Survey Design

One other small weakness was the statistical analysis and presentation of the survey data. The criticism would be that the survey was similar to any survey that might be conducted where you then look at simple values of high or low to make determinations. When working in the Office of Student Life we often developed and deployed surveys that were of the same complexity of this survey. The outcomes of this survey was then analyzed and presented in a somewhat confusing manner. However, the findings were important and could have potential for a startup or organization to improve IDEs because this is something that does need work.

**Analysis of Interdisciplinary Nature**

**How well did it integrate the three areas of study:**

    One interesting thing about this was that the areas of study were Computer Science, Psychology and Psychology. The research was very interdisciplinary in nature and actually it is part of a broader area of Computer Science called Human Computer Interaction which is how humans interact with computers and has a heavy psychological component. This research directly applied Psychology concepts to analyze a purely Computer Science area. I would say that it clearly utilized concepts of Psychology and Computer Science and did so in a meaningful and important way.

**Does the thesis meet the expectations of interdisciplinary study:**

This thesis did seem to meet the expectations of an interdisciplinary research study. I also think that this research question could just as easily been undertaken by a non-interdisciplinary student in either Computer Science or Psychology. It did seem to have a heavier focus on Psychology and did not build upon some of the more complex theories and research found in Computer Science. I also felt it interwove them well as it is often easy to just use methods from one field and apply them to another field. This research really integrated the theories of both disciplines to look at an interesting and important question.

**Conclusion**

    I was really impressed with this research and the idea behind it. It seemed like it laid the foundation for further research or the opportunity for a startup to develop software that incorporates motivation into the development of IDEs. The topics taken on were rather broad in scope and if it was pursued as a doctorate dissertation I felt it would be needed to greatly reduce the breadth and bring its focus to a much smaller area. In conclusion, I would pass this research but if I was the lead adviser would probably ask for at least a little more depth of research in both fields and a chapter related to computer science theory.