Combining Project Based Learning and Lean Six Sigma Methodologies to Teach Robotic Process Automation Analysis and Design

William H. Money
The Citadel
Lionel Q. Mew
University of Richmond

Abstract

This paper uses a Project-based team instruction methodology with open-ended projects to teach students critical analysis, design and implementation steps of developing Robotic Process Automation (RPA) for information systems. The use of project-based learning is appropriate for teaching RPA analysis and design with lean Six Sigma tools because of its experimental approach and documentation of logical steps needed to learn how to successfully implement RPA. The approach systematically documents work currently performed and defines future actions of the process while ensuring significant benefits are achieved with the RPA enhanced process. This methodology is important because RPA is not commonly taught in Management Information System (MIS) programs. MIS students may not understand the significance of combined methodology, RPA tool, and usefulness of RPA until they enter the workforce where RPA is rapidly becoming available and easier to implement. The lecture sessions and exercises are valuable because it is easy to communicate the value of RPA in terms of time, quality, volume of transactions, etc. using Lean Six sigma analytic approaches. The exercises involve hands on activities to make this learning experience interesting for students to readily associate the theoretical process improvement agreement and visualize practical value of projects. The sessions require limited prior knowledge of these subjects. This paper presents a project-based methodology and design approach focusing on development of RPAs. The projects deliver great benefits to organizations and engage students in key activities of the analysis, design and development process from a low code-no code perspective.

Keywords: Robotic Process Automation, Six Sigma, Project-based, PBL, Process

1. INTRODUCTION

A prerequisite for efficient collaboration within and between organizations is integration of information systems. As information systems proliferate, opportunities for IT systems integration have increased greatly. However, difficulties with integration continue due to technical and data related problems. Despite intensive research on integration issues, organizations continue to encounter significant challenges. Schmidt, Otto, & Österle; (2010) developed a research framework categorizing concrete integration cases from business practices developed from examining integration cases from the literature. The work proposed 9 problem categories and 21 integration problems plaguing those efforts. The detailed problems that inhibit integration vary from differences in business segments, goals, and roles, to semantic, data object heterogeneity, data value mismatches and attribute differences. The conclusion from this work and the literature is that there are many open challenges of integration in the Information Systems discipline (Schmidt, Otto, & Österle; 2010).

Robotic Process Automation (RPA) tools are a no/low code approach that incorporates software tools and templates to integrate systems and process operations. Low-code and no-code approaches use visual software development

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tools and environments to enable developers and end-users to select and drag and drop application components, which are then connected to create applications and programs.

The RPA technology is a variation of the low-code/no-code environments developed following the Computer Assisted Systems Engineering (CASE) tool failures of the 80's and 90's. They became a development alternative because few case tools were successful for complete database application generation. The case tools were costly and difficult to implement and maintain, requiring extensive training for developers and systems maintenance personnel (Schmidt, 2006). Jones (2002) notes that as much as 70 percent of CASE tools were not being used by the end of the first year. This generally accepted software failure figure (believed to be based on the 1994 Standish Chaos study) has been questioned by Glass (2005). He argues that the failure is assessed from varying perspectives such as cost over runs, functional performance, etc., and that the true rates are lower. However, there is no question that failure rates during this period were sub-optimal.

RPA's no-code characteristics and drag/drop technology are similar to other low-code development environments such as Mendix, a low-code Model Driven Development (MDD) platform that also grew from the Computer CASE tools of the eighties and nineties. Tools like these enable system development to occur at higher levels of abstraction and generate fully functional applications from a model driven environment (Hailpern & Tarr, 2006). The higher levels of abstraction are achieved by automating and simplifying application development steps using the context of domain models. The tools employ templates, generate code, and in some cases, generate fully functional applications.

Hyun (2019) provides a useful example of this approach with a discussion of an environment-based low-code and no-code execution platform and an execution method that combines hybrid and native apps. The low-code/no-code method offers hybrid and native app advantages. The environment enables the use of iPhones, Android devices, and operation templates. The development platform is a visual integrated environment that enables drag and drop components by non-technical developers. The environment to construct modules can be dynamically loaded when called. The system provides functionality for authentication, user authorization, commerce, messaging, social publishing, and vision.

Early releases of RPA sought to minimize coding. Many tools seem to be approaching a high level of ease of use today. However, it is marketing jargon to say that they are low code or no code. The users of the early RPA tools were required to incorporate logic and instruction programming to complete the automation process. Avoiding market marketing jargon, the low-code RPA automates straightforward processes through a drag & drop user interface or that executes a user's activities. Coded bots can still complete more complicate or complex process. The low/no code tools are presently used to complete and automate standard work tasks, such as Excel operations, email responses, report creation, and authorization recoding. Full no-code RPA is currently not clear. However, user prototyping and testing of RPA tools can readily assess the ease of use and coding required. Progress is being made.

Although the low-code/no-code development approach has become an increasingly important factor and tool for many current software development challenges, it is not always adopted. The global trends do not always represent popularity, adoption and use of the low-code/no-code development approach. This was assessed in the Slovenian environment with regard to one specific toolset, Power Automate. The results showed that use of this low-code/no-code development approach in Slovenian organizations is low because of limited usability and functionality concerns (Beranic, Rek, & Heričko; 2020).

The need for RPA is couched in the integration required to need to improve legacy systems regardless of the environments available for system operations. The movement of systems to the cloud, combined with integration difficulties, promulgate the lift/shift approach of cloud migration. In this migration approach, information system and application are migrated into a cloud environment without making process changes even when systems are moved into cloud environments with available resources (Engelsrud, 2019). As seen in cloud-computing adoption, many large organizations are struggling to obtain the full value of the migration to the cloud. This is because the cloud migration simply moves information systems to the cloud without the integrating functions and possibly transforming processes with new strategies needed to get the full value of the cloud. Utilities can simplify the packaging, migration, and deployment of applications for the cloud whether the target is AWS, Google Cloud, Oracle Cloud, or other cloud infrastructure. However, without

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improvements or resolving process integration concerns associated with systems integration, taking legacy applications and moving them to the cloud does not automatically yield the benefits that cloud infrastructure and systems can provide because the work processes are still not integrated. The information technology architectures that are the result may be complex, difficulty to manage, and costly (Bommadevara, Del Miglio, & Jansen, 2018). It is critical that systems not be simply migrated to the cloud, but that work processes be integrated to the cloud infrastructure.

A PBL educational approach is an appropriate teaching method for students who *must* learn about cloud migration and how to integrate systems. The true objective is to improve performance with analysis using lean six sigma techniques to document and target system improvements that will have great benefit by performing functional system tasks and improving operations.

2. EDUCATION FOR INTEGRATION

Students must understand the importance of and processes to integrate systems. In large projects and organizations with decentralized work packages and task areas, it is important to properly integrate the various outputs to provide the customer with a coherent deliverable. MIS students who join organizations that design and support information systems see first-hand how the work performed by organizational information systems is subdivided into segments for functional performance and completion. This concept – the division of labor (specialization) is evident in the systems that are used by various division, departments, and offices of organizations.

The tasks contribute to productivity increases by focusing on the tasks and data used by each functional area. For example, in the field of manufacturing, use of business applications has expanded significantly over the years. This expansion has increased both the availability and volume of planning and execution information for managers and decision makers. The information enables decision makers to assess and monitor performance at all levels of the organization. Developed applications let end users obtain predefined management reports including information needed for managerial execution. The information is of significant value for strategic planning, increased productivity, reducing service cycles, reducing product development cycles, reducing marketing life cycles, increasing the understanding of customer's needs, thus facilitating business and process reengineering (Sharma, 2012: 553). This breaking up of work elements is essential to delivering large projects. However, the breaking up and decentralization makes it difficult to assemble and integrate tasks for a coherent deliverable to the customer.

Managers and organizations remain faced with the significant task of assembling and integrating the divided work elements to produce the output desired by the customer. Further, managers must deal with changing into business and organization environments that lead to changes in the data, knowledge information systems and business strategy.

To gain the greatest benefit from information systems, one must also understand the relationship between knowledge and information system strategies, and their overall impact on firm performance. It is important that the dynamic capabilities of knowledge strategy and planning result in necessary changes in systems to enable dynamic and innovative capabilities to be developed. Findings from a study of 234 Brazilian companies support this logical argument. It finds performance was positively impacted through alignment between knowledge strategy planning and information systems strategy. Managers must recognize that the work of the firm is dynamic, and that alignment between information systems and the strategic actions of the organization is important to success (Yoshikuni, Galvão, & Albertin, 2021). So, knowledge and information system strategies must also be reconciled and integrated.

Research and improvement attempts have focused on business processes supported by information systems (and the data, information, and knowledge derived from the systems) for many years. Business has been designing and integrating processes as business and industrial organizations evolve to offer systems that are more complex, useful data, insights, and knowledge for decision makers to support the requirements of highly complex stakeholder demands and governance regulations. It is therefore important for students entering the workforce to understand these concepts in order to integrate work segments and processes into a coherent whole to provide a holistically consistent system.

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How to Integrate Systems in the Age of Processes and Computerized Information Systems

Porter and Millar (1985) discussed linkages between computerized information systems and the integration mission, and projected a future role that information technology would play in the value chain. They argue that information technology and information that businesses create would enable management to employ this information in work processes. Those would provide an advantage derived from the information-processing component that executes steps required to capture, manipulate, and channel the data. This support enables managers to perform the value chain activity. The data handling improvements are attributable to barcodes for error handling reductions, databases for knowledge and experience storage, management of services with data, improved weather satellite data uses, financial analysis through data, transfer of data between suppliers and manufacturers, data for improved designs for manufacturing coordination, uses of office support data, and communication data.

The value chain framework addresses the role of computer information systems in achieving helpful integration. White and Person (2001) suggest this as a framework for integrating a firm's activities within a supply chain. They recognize the requirements for integrating customer service activities into the decision-making process of manufacturing organizations. These authors also discuss the dynamic nature of the organization, and argue that just-in-time computer systems and new product, process and information technologies provide the mechanisms for integration of the various supply chain task activities.

The tasks and processes are viewed as frameworks containing steps in a sequence. The processes have many components, agents, and outcomes. The many authors and managerial perspectives indicate that difficulties with the integration of organizational processes have always been challenging. As these references summarize, within the last 40 years, information systems implemented with electronic technology through computer information systems and electronic data processing technologies have been "inserted" into this essential mission of attempting to manage processes and their data, and improve the coordination and integration of the work within and between organizations. As Schmidt, Otto, & Österle (2010) discuss, this integration requirement for information systems is a prerequisite for efficient collaboration within and between organizations that results in substantial tasks.

Information systems have grown and become ever more complex to meet the needs of large organizations. The large category of enterprise information systems has become standardized with more carefully defined data and processes to broadly meet the needs of many large organizations, and for wider marketability. This tendency has led to criticism of the enterprise systems, with their many sub-functions and operations that emphasize their limited adaptability and reduced functional and operational flexibility.

Information systems such as Enterprise Resource Planning systems are caught in this dilemma. It is exacerbated by the large enterprises and matrix structures of originations that utilize federation (decentralized control and development of some functionality) as their information systems implementation approach. The standardized enterprise systems are thus less flexible and adaptive, and the decentralized enterprises are incapable of exchanging and making information available in many instances, and lack visibility. A large adaptive enterprise requires information systems to meet a business strategy that can make information visibility across the enterprise and flexible for use in new and innovative ways (Evgeniou, 2002). This integration is critical.

General Problem with Major Applications

The need for change after implementation was addressed by Gattiker, & Goodhue, (2005). They offer the theory, supported by their research, that because these systems include data and effect greater process integration, an ERP will be a relatively better fit, requiring fewer changes, when interdependence is high and differentiation is low among/between the subcomponent of the company using the ERP. If differentiation is high at the subunit level of the organization (business function or location, such as a manufacturing plant) ERP customization will be required. Further, the amount of time since ERP implementation will increase the need for further customization (supported by a large number of manufacturing plants).

A comprehensive discussion of ERP systems published by Sheik, & Sulphey (2020) discussing Enterprise Resource Planning (ERP) failures and limitations over the past 20 years indicates that implementation is still difficult, and changes after

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implementation are still required. It identifies the reasons for failures documented in numerous ERP studies. The literature recognizes many types of failures associated with information systems project implementation, planning, management support, culture and management process. The work is useful because it notes that even overcoming these issues does not assure a success for an ERP system or the organization seeking to obtain value from this effort. These authors discuss the tendency of organizations to underestimate the efforts needed to handle change in the organizations. In these initial implements ions, ERP systems can affect any functional area of the company's basic, economic, and require systemic modifications. Integration is required.

In discussing the problems in large scale ERP implementations, research studies of integrated supply chain show that effective operations and integration are achieved by linking information from suppliers, partners and customers within and across national borders. This can be by implementing information technologies and systems such as ERP to facilitate the desired level and details needed for integration. There are cases of successful and unsuccessful implementations. The principal reason for failure is often associated with poor management of the implementation process.

This paper identifies and number of the types of issues that can arise and require adaption for ERP systems within a large manufacturing organization. Core issues to confront in successful implementation of enterprise information system is this case study were addressed piloting a small portion of the enterprise implementation to assess and demonstrate how business principles, processes, procedures, role definitions and behaviors (as well as software, hardware and data transfers) would impact the organization. The initial problems experienced in the attempt to *go live* Included: 1) user authorization and clearance levels, work routing and tracking (via cards), incorrect data values between the legacy systems and the new system, incorrect inventory levels and WIP data, and incorrect MPR transactions (Yusuf, Gunasekaran, & Abthorpe, 2004). Adaptation is necessary throughout the development lifecycle.

User Developed Apps and Desktop Tools Proliferate with Increased Workforce Mobility

Development frameworks are necessary. Large enterprise systems and changes are not the only forces driving information systems today. User empowerment, education, and the widespread use of technology have influenced the organizational end user. Workers are not afraid to develop apps and seek to access information needed in their work activities through user development and the wide spread proliferation of desktop tools.

Coronado, Mastrogiovanni, Indurkhya, & Venture (2020) addressed this increasing demand for tools and expansion of interest in user developed information systems. Individuals will trust robots to work in industries and in scenarios where the robot is directed by an information system (perhaps some form of AI) to interact with humans in social activities. They surveyed user development environments that might foster application development involving robots with social capabilities, features that could support social research goals, and serve professional employees not educated or trained in more traditional programming languages and techniques. The work identified sixteen programming environments with modeling approaches, Component-Based Software Engineering, and web technologies. They found that few of the environments enable end users to be independent from high-tech support. Their work calls for objective and comparative evaluations, usability studies, and design validations of the tools for designing working applications. Engaging robot-based applications requires the availability of usable, flexible and accessible development frameworks that can be adopted and mastered by practitioners who are truly adult end users.

3. METHODOLOPGY

This educational experience applies a Project Based learning (PBL) approach to the learning experience. The learning experience is agile based. It involves an introduction to the requirements for changes and adaptations for enterprise information systems, and the continued need for user developed applications that work in the desktop environments and in mobile applications.

Analysis: Lean Six Sigma Designs Steps for Value

The goals of improving flexibility and supporting operations has contributed to the Six Sigma approach to process improvement and selecting changes to implement in organizations. It is a strong foundation for improvements and

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innovations because it involves doing the work better and actually improving the work "to be accomplished" in many instances. It is applicable to process used to produce products, services, markets and operations. The work focuses on customer needs, detailed data analysis and facts about performance levels, errors, and required actions.

Analysis of organization results derived from the application of Six Sigma programs show improvements in broad-based innovation and financial performance. The key characteristics of their approaches include an improvement - innovation vision based on data (from customers, insights, and analytic studies), clear and objectives, organizational commitment to the change objectives or vision, alignment across the organization, training, and target processes to demonstrate the Six Sigma program.

Lean Six Sigma is a combination of lean methods (analysis, documentation, and analytic tasks that are performed within the organization) and Six Sigma approaches that organizes the tasks in an understandable and executable fashion. Lean Six Sigma utilizes knowledge (from the experience of many organizations that have followed the approach), methods designed to elicit specific data and understanding of activities and operations, and tools derived from operational improvement research and implementations. The *lean* portion of the approach targets cost reductions through process optimization. The six-sigma portion focuses on meeting customer needs and stakeholder expectations. It seeks to improve quality, via measurement and defect or error elimination. This can be done by both eliminating the opportunities for errors in a process and improving the steps, materials, and performance of a task. The simultaneous goals are to achieve both effectiveness and efficiency (Byrne, Lubowe, & Blitz, (2007).

There are five major steps in ae lean six sigma process as shown in table. It is labeled "DMAIC", an acronym for the five sequential phases: Define-Measure-Analyze-Improve-Control. These phases, low logically from defining a problem through implementing solutions. The changes are associated with causes (George, 2005).

Table 1. Summarized Learn Six Sigma Steps

Step Name	Value
Design	Review, validate charter, customer, problem, benefits sought, financial objective, plan, schedule
Measure	Value stream map, inputs, operational definitions, data collection plan, measurements, process capability, measure gate
Analyze	Determine critical inputs, potential root causes, reduce root cause list, estimate root cause effects on outputs, prioritize root causes
Improve	Develop potential solutions, analyze and evaluate solutions, develop "To-Be" value stream map, develop pilot solution, confirm attainment of project goals, develop full scale implementation plan
Control	Implement mistake proofing, SOPs, training. Process controls, implement solution and on-going process measurement, develop opportunities to apply project lessons, transition to monitoring control office

Analysis Results: A new Process Design

The result of the analysis using the steps outlined is a process that will perform more effectively and efficiently. Further, the approach and tools employed document the pre – post outcome metrics that will be used to show that there are real benefits and improvements form the process changes.

4. RPA IMPLEMENTING THE AUTOMATION

The objectives of this learning experience are to deliver students a clear understanding of the technology and method that can be applied to design and plan to introduce RPA enhancements to processes and information systems. The lessons focus on RPA tools and use various product offerings to provide a hands-on set of educational exercises. This section discusses RPA and how the tools implement the designs documented, and provides an overview of the tools that will be used in the exercises.

Robotic Process Automation

This paper argues that Robotic Process Automation (RPA) is a recent improvement (evolving in the past ~ 10 years) in computer

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information systems. This technology is applied in organizations to achieve integration between systems and to perform mundane and repetitive tasks without changing the information systems that ate targets of sources of the data required. RPAs execute rule-based, routine, and predictable tasks in combination with structured, understood, and stable data in a semi-automation and automated manner. (Primer, 2015).

RPA Functionality and Operation

How does RPA perform integrative and productive tasks? RPA moves data and information seamlessly between systems and processes. RPA technology can be implemented across many functions and a practical linkage technology for many different process focused tasks (definable, repeatable and rules-based). It can be optionally executed at the explicit direction of employees and can therefore assist them in their work. RPA can assist with diagnosing when decisions are not always clear (the data do not legitimately fit) and the business rules-base is not complete for all situations (present and those introduced by business changes). In these instances, the "error" or unaddressed states can be recorded and handed directly by the user. New "rules" or actions can be added to the RPA automation to handle the situation when it is encountered in the future.

RPA has multiple operating modes. It can function in attended mode where an employee "triggers" the bot for day-to-day operations or automatically with the employee watching for exceptions and alerts (correct execution or failure to execute). The bot can also function in an "unattended mode" on a server based on user-determined triggers such as a date and time like running at 12:00 am on Friday, or when 1000 cases have been received. Thus, the RPA bot can serve as an independent automated process that does not demand human intervention in order to execute a work process and make or execute a decision if all the data and rules are clear and the outcome decisions are predetermined.

RPA is very adaptive and fits many situations because of its internal capabilities. The RPA has several essential features that provide it competencies beyond those found in code written for scripting, screen scraping, and sequential process management. 1) RPA utilizes straightforward dropping and dragging via icons that represent steps in a process. RPA process code is then produced automatically without extensive programming, computer training or expertise. 2) The RPA bot accesses data produced by other computer systems or programs. It emulates exactly how an employee accesses this data (because the bot is created to do just this task). RPA has important security and operational controls. The RPA assumes only that logon ID and password of the user. This is required to access what is normally seen or obtained by the worker from the target or other system's presentation layer. Therefore, the RPA bot is non-interfering or invasive for organization work beyond the explicit instructions executed by the bot's design. 3) Finally, RPA is a secure and scalable technology that executes on the enterprise-protected platform. It can be configured, audited, and managed at the enterprise or organizational level that utilizes this technology.

The output of a bot appears to be the product of code that functions "like a macro," but with more capabilities, options, and functionality that is not restricted to an application like Word or Excel. It can be visualized as a very smart, tireless, and sophisticated desktop assistant. The bot appears as a powerful worker or "aid" that performs scripting and screen scraping (record and replay), acts quickly, and is able to record (without error) what it is doing. Then the bot aid replicates the assigned task repeatedly (tirelessly) – like a true robot. It is trained by watching a user's selections (of data or decisions), recording mouse clicks, matching inputs from the key board and completing the process as the user does. However, the bot is not intelligent – and does not know why it is doing this work since it only performs the assigned set of actions when called upon. (Madakam, Holmukhe, & Jaiswal, 2019; Peláez, & Kyriakou, 2008; Schmitz, Dietze, & Czarnecki, 2019).

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RPA Products

Table 2. RPA Tools

Product Provider	Product name and Description
Power Automate	Power Automate is a business tool (Microsoft code) that automates business processes, sends task reminders, move business data between systems on a schedules, connects data sources or and publicly available APIs, can automate tasks on a local computer.
Automation Everywhere	Automation Anywhere consists of three core components – Bot Creator (drag and drop method to create rule-based automations), Control Room (hub for RPA robots start, paused, stop, or scheduling), and Bot Runner (run robots. provides the end-to-end status of the bot's execution back to the control room). They are used in tandem to build and deploy a successful automated workforce.
UiPath	UiPath offers complex and highly feature automation more complex automation products (standalone end user - not integrated, hosted – on premise, cloud) corresponding to the user deployment requirements. Products include development environments – Studio, Automations – assistant (bots), Orchestrator – management and control. Cloud and hosted product link together and can exchange data when installed as Automation Suite.

5. Project Based Learning (PBL) EDUCATION EXPERIENCE

What is Project Based Learning (PBL)?

Project-based learning (PBL) is a learning experience that engages students in experiential activities. The students are able to learn and develop skills while working in teams. This stresses real-world projects that can be understood readily and have significance for the students. Larmer & Mergendoller (2010) propose the project be a task that matters, that the students will want to do well, and the project be well designed and well implemented to serve an educational purpose.

Larmer & Mergendoller (2010) propose seven essential characteristics for these experiences. The criteria listed below are conceptual ways of involving students in the exercise.

Table 3. Essential Exercise Characteristics.

1	A Need to Know	Relevance of the information
2	A Driving Question	How to improve, reduce, speed up, etc.
3	Student Voice and Choice	How to reduce tedium, improve situation, minimize errors),
4	21st Century Skills	Collaboration, communication, sharing
5	Inquiry and Innovation	Gathering information, alternatives, suggestions for improvement
6	Feedback and Revision	Critiques, reviews, examinations of project work
7	Publically Presented Product	Exhibit and present the solution
	(Larmer & Mergendoller, 2010)	

Amaral (2021) described how projects taught by using the PBL approach could have different goals, and actively involve students so they actually get their hands dirty. This work notes that students might learn and discover skills and materials required to complete the project. They will also reassess their learning process at the end of a project.

Value of PBL

The project technique is effective in imparting the educational ad learning experience to students. Alacapınar (2008) assess how the delivery of a course using the project-based learning technique affects student opinions on cognitive, affective and psychomotor domains using questionnaires and semi-structured interviews. The results report on project technique effectiveness. The interview feedback results are that the project technique enhanced their creativity, helped them acquire high-level information, affection and skills, work and collaboration, and that separation into groups during the work consolidated affinity, trust and friendship.

How PBL Works For Lean Six Sigma and RPA

The projects used in the class sessions apply the seven essential project design elements as a framework. The interesting and relevant problem is how to complete the work required of an administrative assistant in situation where the work is tedious, repetitive, with manual steps,

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error prone and required to have very high accuracy, moving and validating data submitted by emails, and spreadsheets to reporting, display and other file formats.

The project is meaningful because it is work derived from real world tasks, and essential to the job and eventual promotion. The project deliverable is a working system utilizing the RPA tool.

Appendix A lists the steps a student will execute to complete the analysis, design, and coding of an automation (bot) using two different RPA tools. The first exercise provides the steps for the use of Power Automate, a simpler and easier to use RPA tool with basic product features. The second exercise utilizes UiPath Studio to perform the task. This tool has more features and functionality. Appendix B lists the task actions a student will execute to complete an RPA project with straightforward output objectives. Appendix B task actions can be perfumed with either tool

6. CONCLUSIONS

This paper describes the use of project-based learning to teach design skills to management information system students. The general issues considered in the design of class sessions assess the use of Lean Six Sigma and RPA in improving organization tasks. Consideration of the literature on the application of PBL suggests many skills, including problem solving; innovation, group-working and presentation skills desired by employers can be enhanced with this approach. The paper discusses factors involved in the development of problem-based leaning (PBL) sessions, and summarizes exercises planned for the educational experience.

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8. Product Appendix A

Product Exercise - Simple Exercise – Power Automate.

Tool Action Summary:

- Sign up and obtain Documentation. Sign up and sign in - Power Automate
- Power Automate, you can explore a diverse set of templates and learn about the key features for Power Automate. You can get a quick sense of what is possible and how Power Automate could help your business and your life.
- Analyze the desired process, to find an appropriate template. (e.g., templates for sending you a text message, adding Twitter leads, backing up files...)
- Analyze the tasks and set conditions that trigger the flow and the action that results from that event. (adjust, add, or delete actions).
- Select an appropriate flow type based upon the Lean Analysis. (cloud flow, desktop, business process, etc.
- (Optional) Examine code by viewing code generated for all actions and triggers. (for a clearer understanding of the data that's being used by triggers and actions) [Action or trigger > Peek code].
- Select a connector. Connectors are proxies or wrappers around an API that allows the underlying service to talk to Microsoft Power Automate. A user connects to build their app and workflow from software as a service (SaaS) connectors. This connect apps, data, and devices, etc.)
- Test and validate that the new actions and data were created.
- Execute or Run the new workflow. After creating and tested a desktop flow, run it from an event, schedule, or button.
- Manage the flow in Power Apps > select Flows in the left navigation pane

Product Exercise – Complex Exercise – Power Automate.

- Install the UiPath Studio (development tool) from UiPath, or local network.
- Enter required information (name device ID – if not present, > Activate
- 2. Open and select a project, activity (press a key, enter a number, etc.) and sequence (combined task) designation.

  >Choose from: Plan, Simple (template/flow hart – for different sequence of activates), Agent (shortcut for improvement), Transactional (uses states – e.g. loading, execute shut-does – not moving until all tasks for the project are completed

- Build the project. Create a name,

  Add a function (record, scrape, user event, value), >Run, test
  Scrape (screen or web), user event (keyboard or mouse entry). Set variables
  Create file (separate parts of the automation)
  Activity – drag and drop into the activity program (pane).
- Domains (7) – UI domain – keyboard, mouse. (drag/drop activates according to the project logic),
- User events (triggers); orchestrator – depending upon edition; system (delete, open); condition programs (fi. Else); workflow - sequencing
- Properties – set addresses, locations
- Control bar – Used to create the components for variable, arguments, imports.
- Create an automation.
- Test and install in production

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9. Project Activity Appendix B

1. Create file output from Excel (Task assignment, Excel file, output required)

2. Create email upon task completion. (Task assignment, Excel (or other source file), email message - output required)

3. Create message of data arrival, update file. (Trigger for automation, Excel (or other record file), email message - output required)