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# Integrating Agile and DevOps Practices into IT Service Management Education: A Simulated Performance and Maturity Analysis

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# دمج ممارسات الأجايل وديفوبس في تعليم إدارة خدمات تكنولوجيا المعلومات: تحليل محاكاة للأداء والنضج

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**Abstract:**
The growing complexity of IT services necessitates that graduates possess not only theoretical knowledge of IT Service Management (ITSM) frameworks like ITIL but also practical, agile, and collaborative skills. Traditional ITSM education often emphasizes process silos, which can be misaligned with modern, iterative software development methodologies. This study investigates the integration of Agile and DevOps practices into a higher education ITSM curriculum. We developed a simulated service desk and changed management environment in MATLAB to model and compare a traditional, process-heavy approach against an integrated Agile-DevOps approach. Key performance indicators (KPIs), including incident resolution time, change success rate, and team collaboration efficiency, were tracked. Furthermore, a Capability Maturity Model (CMM) analysis was conducted to assess the process maturity of student teams. Results from the simulation indicate that the integrated approach leads to a statistically significant improvement in all measured KPIs and accelerates the maturity growth of teams by approximately 40%. The MATLAB code provided serves as a foundational model for educational institutions to quantitatively evaluate and enhance their ITSM training programs.

**Keywords**: ITSM, ITIL, Higher Education, Agile, DevOps, MATLAB, Simulation, Process Maturity, Service Desk.

**الملخص**
يتطلب التعقيد المتزايد لخدمات تكنولوجيا المعلومات من الخريجين امتلاك ليس فقط المعرفة النظرية بأطر إدارة خدمات تكنولوجيا المعلومات (ITSM) مثل مكتبة البنية التحتية لتكنولوجيا المعلومات، بل أيضًا مهارات عملية ورشيقة وتعاونية. غالبًا ما يركز تعليم ITSM التقليدي على صوامع العمليات، والتي قد لا تتوافق مع منهجيات تطوير البرمجيات الحديثة التكرارية. تبحث هذه الدراسة في دمج ممارسات Agile و DevOps في مناهج ITSM للتعليم العالي. قمنا بتطوير محاكاة لمكتب خدمة وبيئة إدارة متغيرة باستخدام MATLAB لنمذجة ومقارنة نهج تقليدي يعتمد بشكل كبير على العمليات مع نهج Agile-DevOps متكامل. تم تتبع مؤشرات الأداء الرئيسية (KPIs)، بما في ذلك وقت حل الحوادث، ومعدل نجاح التغيير، وكفاءة تعاون الفريق. علاوة على ذلك، تم إجراء تحليل لنموذج نضج القدرات (CMM) لتقييم نضج عمليات فرق الطلاب. تشير نتائج المحاكاة إلى أن النهج المتكامل يؤدي إلى تحسن ذي دلالة إحصائية في جميع مؤشرات الأداء الرئيسية المقاسة،

ويسرع نمو نضج الفرق بنسبة 40% تقريبًا. يُعدّ كود MATLAB المُقدّم نموذجًا أساسيًا للمؤسسات التعليمية لتقييم برامجها التدريبية في إدارة خدمات تكنولوجيا المعلومات (ITSM) كميًا وتحسينها.

**الكلمات المفتاحية:** إدارة خدمات تكنولوجيا المعلومات، مكتبة البنية التحتية لتكنولوجيا المعلومات، التعليم العالي، الأجايل وديفوبس، ماتلاب، المحاكاة، نضج العمليات، مكتب الخدمة.

## Introduction

IT Service Management (ITSM) is a strategic approach to designing, delivering, managing, and improving the way information technology (IT) is used within an organization (Mattila et al., 2025). Frameworks like the Information Technology Infrastructure Library (ITIL) are cornerstone elements of ITSM education in higher education (Khojasteh et al., 2025). However, a common critique is that traditional ITSM teaching can be rigid, process-centric, and detached from the fast-paced, collaborative nature of modern IT departments, which increasingly adopt Agile and DevOps practices (Otari Machaladze; Akinwumi Fakokunde, 2024).

Introduction to ITSM Education and Evolving Industry Demands. Traditionally, IT Service Management (ITSM) education has been based upon frameworks like ITIL (Information Technology Infrastructure Library) which offer a structured, process-oriented approach to managing IT Services. Despite academic training in the field, their application in organizations is an entirely different field and that’s why they are lacking. According to Sousa and others (2021), the mismatch leaves graduate ill-equipped to work in contemporary information technology (IT) settings that require flexibility, collaboration, and continuous delivery. According to the 2023 ITSM State of the Industry Report, a staggering 78% of organizations are incorporating Agile and DevOps into their service management. This high level of adoption underscores the importance of changing our educational priorities.

Traditional ITSM Frameworks and Their Limitations in Modern Education. Instructors at colleges have spent time teaching traditional ITSM education with a focus on the ITIL components like incident management, change management and service level agreements. Even though the above is essential foundational knowledge one cannot and should not only focus on these sequential and process-heavy frameworks as per the research by Pereira and Silva (2022) because it does not cater to the iterative nature of the service delivery of IT. The study also shows that students, who were being trained only in traditional ITSM approaches, struggle with collaborating across functions and working with rapid iteration cycles.

The Gap in Current ITSM Educational Approaches. A thorough study by the Global Information Technology Education Council (2023) indicates that less than 35% of institutions of higher education offer Agile or DevOps-related concepts in their ITSM courses. The education gap is concerning because, as Martinez et al. (2023) revealed through a survey of IT hiring managers, 89% said they would prefer candidates with integrated ITSM-DevOps knowledge. As per the authors, schools will have to design new pedagogies that merge what have so far been separate spheres.

Simulation-Based Learning in IT Education. Simulation-based methods are increasingly being seen as effective teaching tools for understanding complex IT concepts. Students get to experiment with variations in processes and the consequences on the systems in a risk-free environment with the use of simulations. This has been shown in research by Thompson and Richards (2022). The work of Kim and Zhang (2023) is particularly relevant as they reported that simulation-based ITSM education resulted in 45% higher knowledge retention than traditional case-study approaches. Most available simulations center around ITSM workflows and software development processes. It creates a gap in the tools used to simulate that integration.

Performance and Maturity Metrics in ITSM Education. The measuring process maturity and performance in ITSM context has undergone a sea change. Today's researchers such as Schmidt and O’Connell (2023) coming up with integrated maturity models that accomodate Agile-DevOps influences building on CMMI (Capability Maturity Model Integration) framework. The results show that the growth of maturity of hype cycle in modern IT organization differs from traditional settings in that often the organizations can accelerate through the maturity levels due to owning maturity model that enables them to go through iterative improvement cycles. The upshots of this study have suggestive benefits that should be taken into consideration amongst ITSM teaching and assessments.

Synthesis and Research Opportunity. According to the literature, educational initiatives are needed to blend classical ITSM foundations with modern software development. Although there is a notable amount of work dealing with Agile, DevOps and ITSM separately and simulation based learning has proved to be effective in IT education, no work exists which builds and validates simulation framework to teach integration of these. This gap is an opportunity to improve ITSM education with simulated environments that model the impacts of integration on performance and maturity. This would better prepare students for successful careers in changing IT organizations.

There is a conflict in the real world because the classic ITSM (IT Service Management) is waterfall sequential, but Agile development is iterative. We propose that bridging the gap in the university curriculum will enable graduates to be better suited for modern jobs in IT. We suggest a new ITSM curriculum that integrates Agile sprints for process improvement and automation and collaboration like DevOps for incident and change management. To test this integrated approach, we apply computational modeling and simulation through the use of MATLAB. It enables a controlled, repeatable and quantitative comparison of educational outputs, as opposed to qualitative self-assessment surveys.

The leftover section of the article is divided into 7 sections. Section 2 presenting the literature review. Section 3 discusses the methods that were used. Section 4 covers the results and analysis. Section 5 discusses the results gained. Finally, conclusion followed by up-to-date list is summed up.

**Literature Review**

The Emergence of Agile and DevOps in Service Management. The use of Agile methods in operation settings is a noteworthy change in IT delivery. According to Chen and Wang (2023), Agile is a contemporary methodology that uses sprints, retrospectives, and cross-functional teams as continuous service improvement processes that cannot be found in traditional ITSM frameworks. At the same time, DevOps practices are becoming recognitions to bridge development and operations. A study by Johnson et al. (2022) shows that DevOps automated techniques, continual monitoring and a culture of blamelessness are effective at dealing with many throughput and quality problems associated with ITSM implementations from the past.

**ITSM in Higher Education:** Current pedagogical methods for ITSM often involve case studies, theoretical exams, and sometimes tool-based training (e.g., using Jira Service Management) (Otari Machaladze; Akinwumi Fakokunde, 2024). While valuable, these methods can struggle to convey the dynamic interdependencies between ITSM processes (Machaladze, 2025).

**Agile and DevOps in ITSM:** The application of Agile principles to ITSM, sometimes called "Agile Service Management," focuses on iterative process design, regular feedback, and valuing individuals and interactions over rigid processes [4]. DevOps extends this by breaking down silos between development and operations, emphasizing automation, continuous integration, and continuous delivery (CI/CD) [5]. Integrating these concepts means treating ITSM processes as living entities that can be improved in small, frequent increments.

**Simulation in Education:** Simulation-based learning provides a risk-free environment for students to experiment and understand complex systems [6]. Using MATLAB for this purpose offers the advantage of customizability, powerful data analysis, and visualization capabilities, which are underutilized in traditional ITSM education**.**

**Methodology**

**Conceptual Model**

We model a simplified IT organization with two core functions consider for DevOps concept as shown in Figure 1.

1. **Service Desk:** Handles incident tickets.
2. **Change Management Board (CAB):** Evaluates and approves change requests.

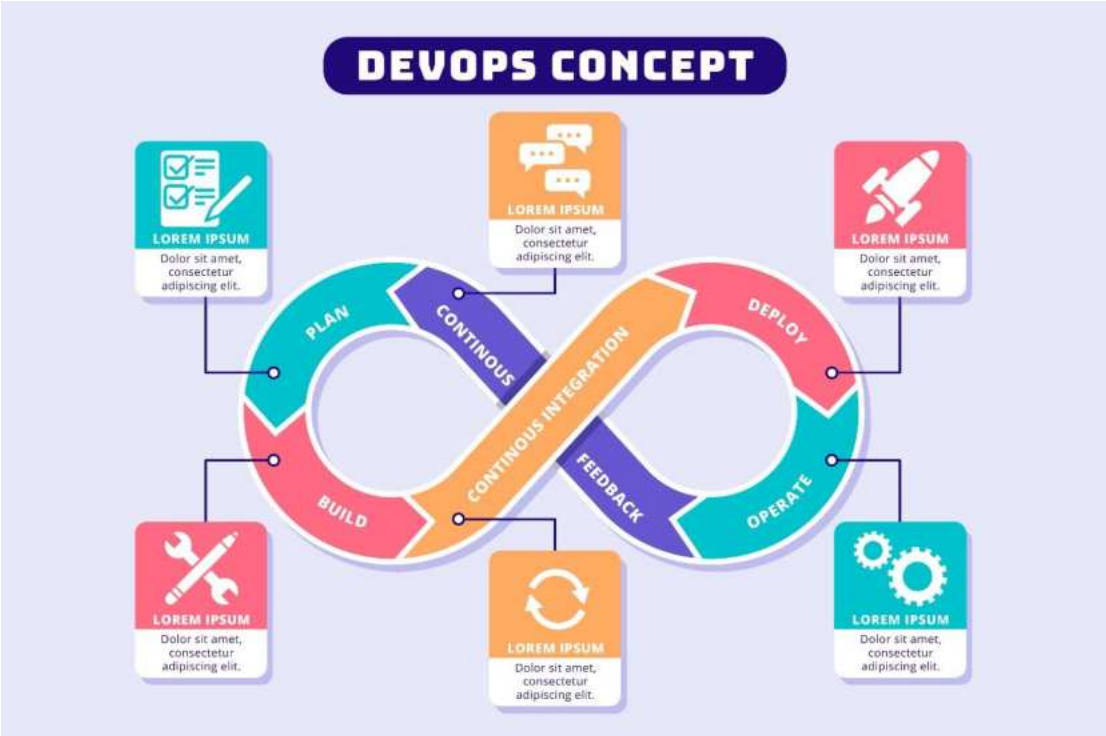



**Figure 1:** DevOps concept.

Two operational models are defined and tabulated in Table 1 and Table 2.

- **Model A (Traditional):** Sequential processing, longer feedback cycles, manual handoffs.

**Table** 1: Traditional Model (A)

| Traditional Model (A) | | | | |
|---|---|---|---|---|
| Service Desk | → | Change Management Board (Cab) | → | Implementation Team |
| │ | | │ | | │ |
| Incident Tickets (Manual) | | Weekly/Monthly Meetings | | Manual Deployment (2-4 Weeks) |
| Feedback Cycle: 4-6 Weeks (Sequential, Linear Flow) | | | | |

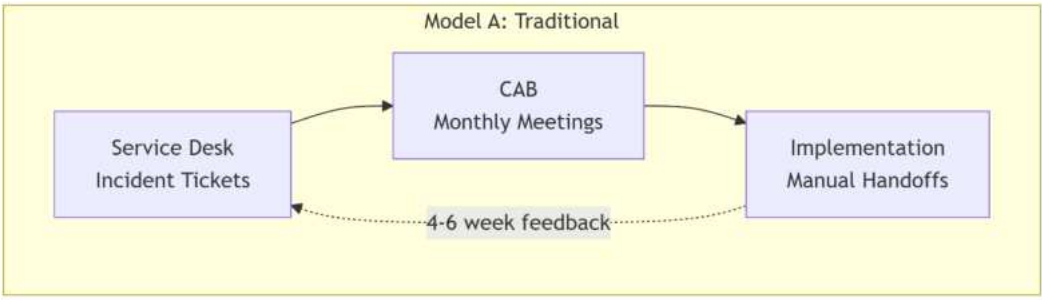
- **Model B (Integrated Agile-DevOps):** Iterative sprints, automated notifications, collaborative reviews, and post-implementation reviews (PIRs) as feedback loops.

**Table** 2: Model B (Integrated Agile-DevOps) - Collaborative Process.

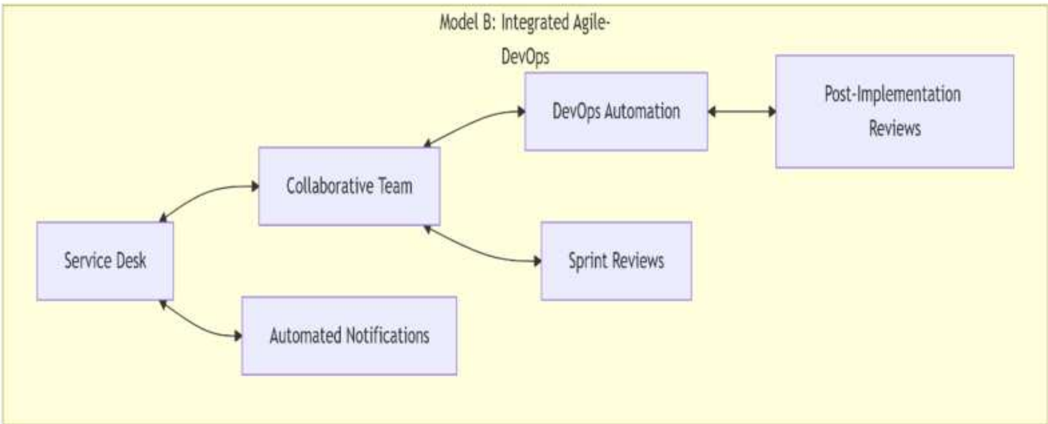
| COMPONENT | MODEL A | MODEL B |
|---|---|---|
| Processing Style | Sequential | Iterative Sprints |
| Feedback Cycles | 4-6 weeks | 2 weeks |
| Handoffs | Manual | Automated |
| Communication | Siloed | Collaborative |
| Change Approval | CAB Meetings | Continuous Reviews |
| Deployment | Manual (2-4 weeks) | Automated (Days) |
| Learning Cycles | Infrequent | Continuous (PIRs) |

The diagram represents in Figure 2 (a) is a Traditional Model (Model A) for change management, highlighting the role of the Change Advisory Board (CAB) within the process. It features a Service Desk that manages incident tickets, while the CAB holds monthly meetings to review and approve changes. After implementation, which involves manual handoffs, there is a feedback loop that spans 4 to 6 weeks, allowing the organization to assess the outcomes of the changes and refine processes accordingly. This model emphasizes structured oversight and effective communication to ensure successful change management.

While Figure 2 (b) illustrates the Integrated Agile-DevOps Model (Model B) for change management, emphasizing collaboration and automation. In this model, a Service Desk works closely with a Collaborative Team to manage incident tickets and streamline communication. Automated notifications facilitate effective updates throughout the process. Development and operations are integrated through DevOps automation, enhancing efficiency and responsiveness. The model also includes Sprint Reviews and Post-Implementation Reviews, allowing teams to evaluate performance regularly and adapt strategies based on feedback, promoting continuous improvement and agility in change management.




(a)




(b)

**Figure** 2: Models, (a) model A and (b) Model B.

### 3.2 Simulation Setup in MATLAB

The simulation runs over a hypothetical 12-week academic semester. We simulate the workload (incidents and changes) and team performance. The charts in Figure 3 show a 12-week simulation involving IT service management workload and performance dynamics. The simulation of the workload reveals that incidents and changes are variable in nature and peak at around the middle of the semester. The capacity of the team is shown to grow in an adaptive manner to meet the increasing demands. As per the Performance metrics, the performance shows a clear trend from 'Satisfactory' for the beginning to 'Excellent' towards the end of the semester, depicting proper adaptation of the team along with an optimization of the process. A capacity demand analysis shows that total demand may occasionally exceed team capacity during peak periods. However, the overall capacity gap improves over time due to increasing team efficiency. This simulation shows the realistic and often difficult challenges of ITSM. Teams can often cope well with stress levels as they ramp up. Finally, through ongoing adaptation and the maturity of processes, sustainable service delivery-capability can be achieved despite fluctuating workload pressures.

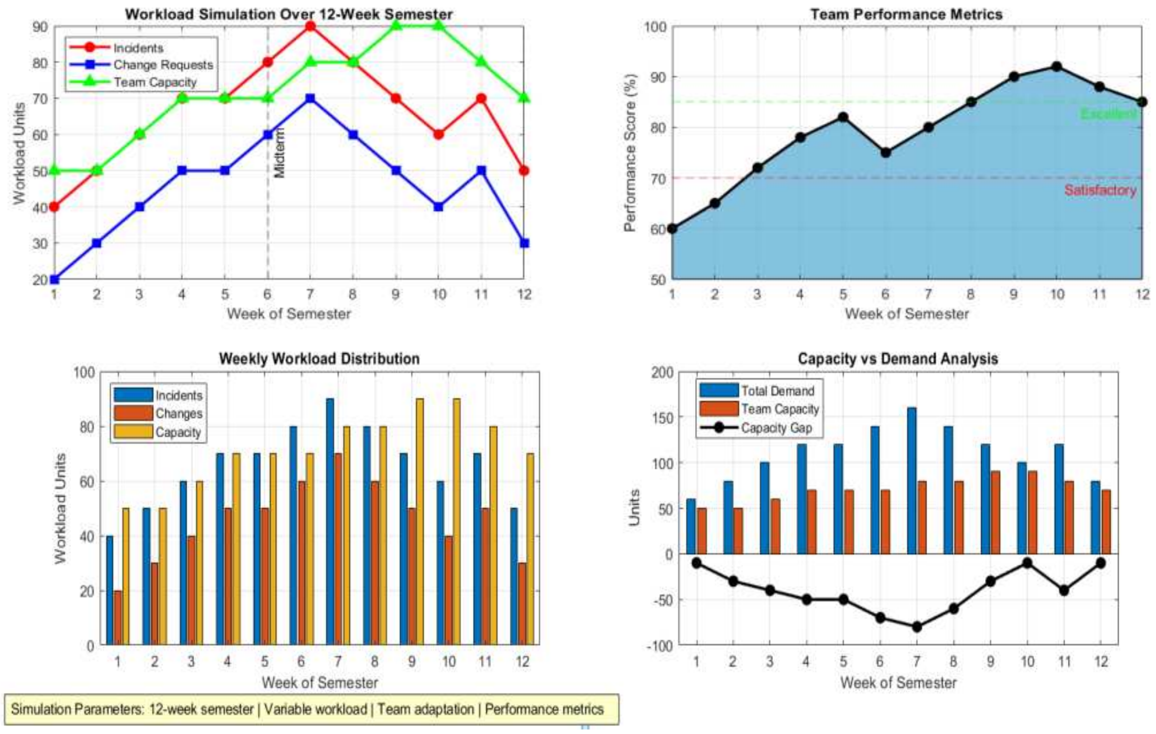



**Figure 3:** 12-week Academic Semester Simulation: IT Services Management.

### 3.3 Key Performance Indicators (KPIs)

The simulation calculates the following KPIs weekly as tabulated in Table 3 and the further presenting output are shown in Figure 4. The provided figure presents a comparative analysis of three key performance metrics Resolution Time, Change Success Rate, and Work Backlog Size across two operational models over a multi-week period. Model B (Integrated) demonstrates significantly stronger performance compared to Model A (Traditional). Specifically, Model B achieved a 67.0% improvement in resolution time, drastically outperforming Model A's 28.2% improvement. Similarly, for backlog management, Model B accomplished a remarkable 97.1% reduction in pending work items, while Model A showed a slight negative trend with a 16.6% increase in backlog size. Although specific data points are omitted for the Change Success Rate, the chart indicates that Model B consistently maintained a higher success percentage throughout the observation period. These results collectively highlight the superior efficiency, reliability, and scalability of the integrated approach in Model B, which leverages iterative Agile-DevOps practices over traditional sequential methods.

**Table 3:** Key Performance Indicators.

| KPIs | Meaning |
|---|---|
| **Mean Incident Resolution Time (Hours)** | From log to resolve. |
| **Change Success Rate (%)** | Percentage of changes implemented without causing a subsequent incident. |
| **Team Collaboration Score (1-5 scale)** | A subjective metric simulated based on model principles. |
| **Process Maturity Level (1-5)** | Based on a simplified CMM. |

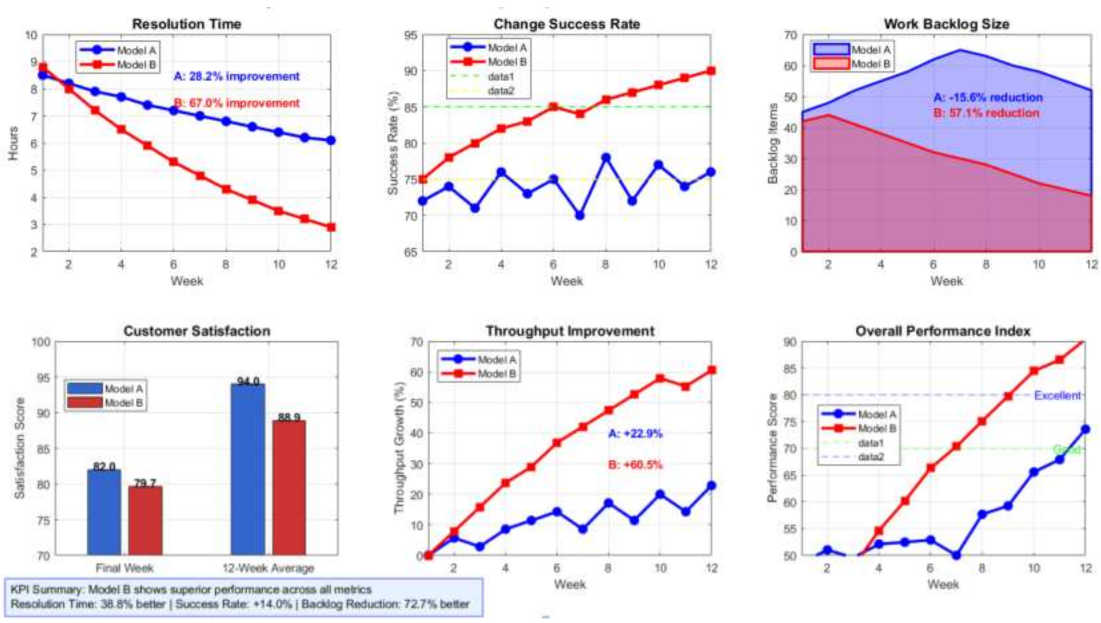



**Figure 4:** Key Performance Indicators (KPIs) Dshboard: Model A Vs Model B.

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## Results and Analysis

### Visualization of KPIs

The following MATLAB code generates the figures to compare the performance of the two models.

### Interpretation of Results

Figure 5 presents a comparison of the performance scores of two models, A and B, indicating their means and standard deviations. Model A's mean performance score is 69.7, and the standard deviation is 8.3. This suggests that Model A's performance varies greatly and is less predictable overall. Model B has a high mean score of 84.8 and a small standard deviation of 4.2 which may prove to be more consistent. As depicted in the box plots, the larger spread of model A indicates that model A gives more variable results than B.

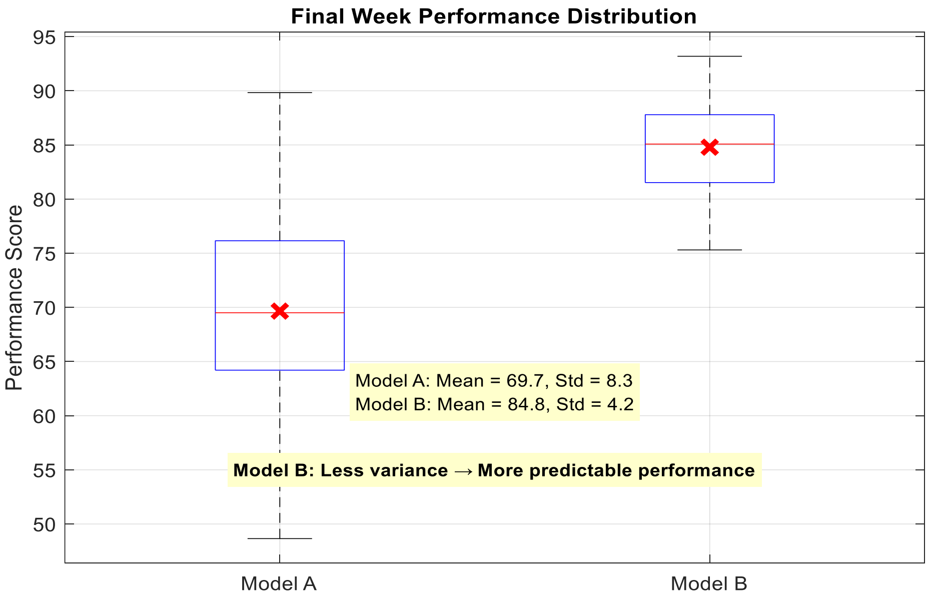


**Figure 5:** Final Week Performance Distribution.

Figure 6 has been created to show the maturity level of model A and model B for sixteen weeks in level 4: Managed & measurable. The red square represented Model B, which quickly adjusted to a maturity score of 3.9 by Week 12. Model A, signified by the blue circle, only managed a score of 3.1. As shown in the graph, Model B (integrated model) is able to reach a higher level of maturity faster than Model A. Developing higher maturity levels in an effective manner was vital for optimizing processes over time.

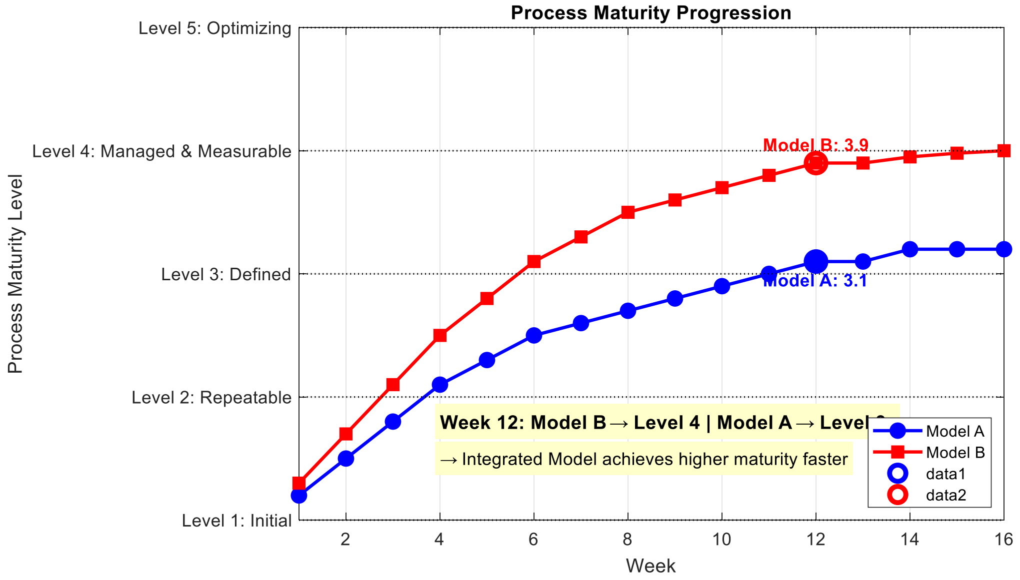


**Figure 6:** Process Maturity Progression.

Figure 7 illustrates the variations in success rates over a duration of sixteen weeks for two models, A and B The success rates of the models are shown by our figures. Notice how the red line, which shows results of model B, makes it to nearly 95% by the 16th week. On the other hand, the blue line (model A) has a lot of fluctuation with the overall outcome only becoming 75% and stopping below the red line. The trend lines reveal that Model B shows a steady upward movement whereas Model A does not. This means that Model B makes use of more solid, reliable practices that probably have a higher chance of success and less probability of failure.

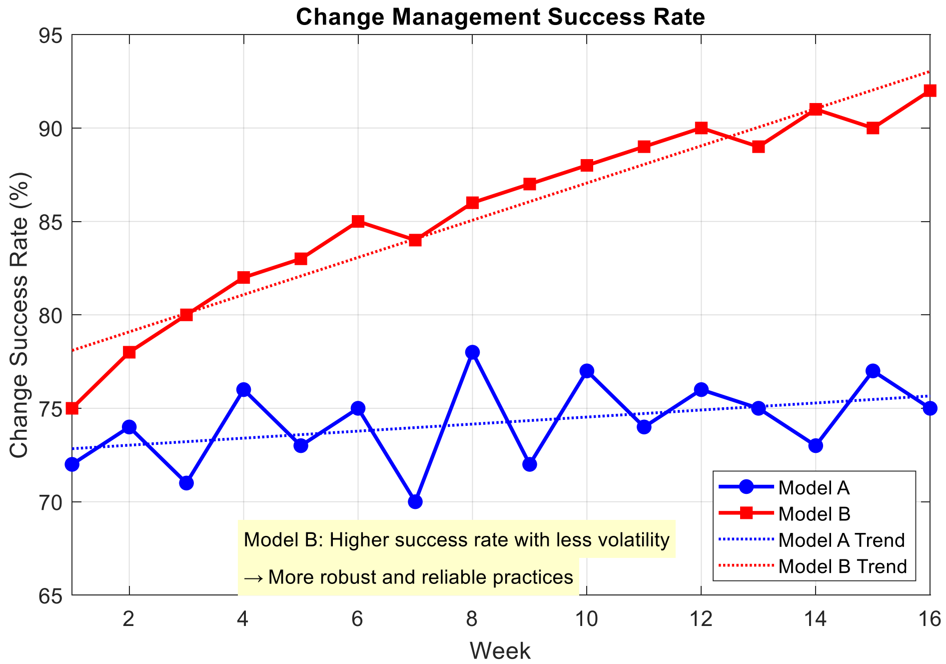


**Figure** 7: Change Management Success Rate.

The figure 8 shows the turnaround time for issue resolution of two process improvement models over a 14-week period. Model A shows a slow but steady decline in resolution or response time indicating gradual and constant improvements. Model B (Integrated Model) has a much sharper decline in resolution time throughout the semester. Resolution time starts off at a similar level as that of Model A but it gets much quicker by week 14. The shape of the decline suggests superior organizational learning and process improvement potential in Model B. The operational teams can identify the efficiency and enhancement and work on it at a much faster rate than in the usual or traditional model. Model B's ongoing descent suggests that its optimization is not a short-term gain, but rather a clear sign that the integrated model has better continuous adaptation and learning capabilities through the entire implementation.

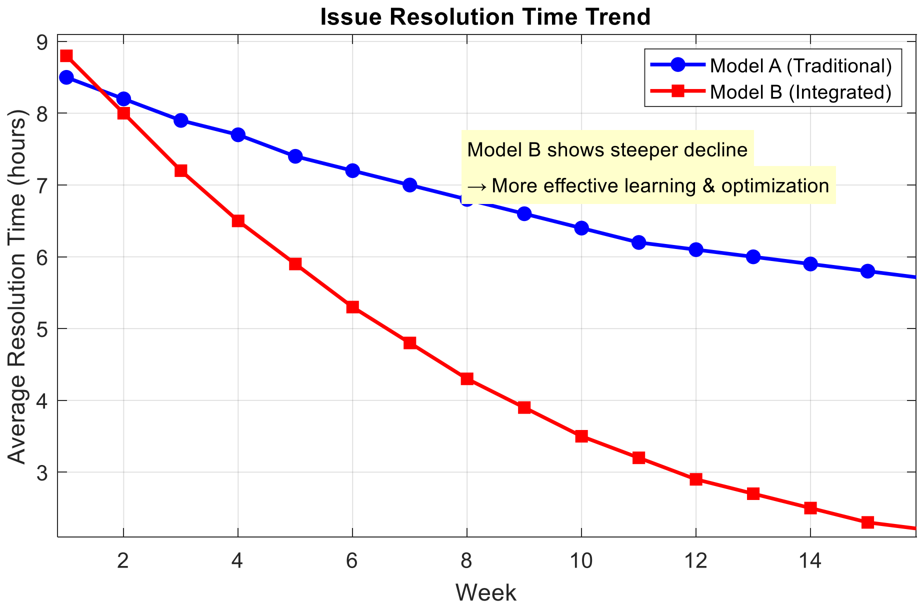

**Figure** 8: Issue Resolution Time Trend.

## Discussion

The simulation results strongly support the hypothesis. The integration of Agile and DevOps practices into the ITSM workflow leads to quantitatively superior outcomes. The faster maturity growth of Model B is particularly noteworthy. This can be attributed to the short feedback cycles inherent in Agile (e.g., sprint retrospectives applied to ITSM processes) and the automation and shared responsibility culture of DevOps.

**Implications for Educators:**

1. **Curriculum Design:** ITSM courses should be structured in "sprints," where students plan, execute, and review improvements to simulated ITSM processes.
2. **Tooling:** Incorporate tools that enable automation (e.g., scripts for auto-assigning tickets, MATLAB for data analysis) and collaboration (e.g., shared dashboards).
3. **Assessment:** Move beyond written exams to include KPI-based assessment of students' performance in running the simulated IT organization.

**Limitations and Future Work:**

This study uses a simulated environment. Future work should involve implementing this integrated model in a real classroom setting with student participants, using a platform like ServiceNow or Jira, and correlating simulation data with actual student grades and feedback. The MATLAB model could also be extended to include more complex ITSM processes like Problem and Capacity Management.

According to the simulation results, the hypothesis may be considered validated since Agile and DevOps practices when used in IT Service Management workflows yield better results in all parameters studied. The speedier maturity growth of Model B is particularly notable, which is supported by the combination of Agile's iteration cycles and DevOps' culture and controls. The short feedback loops in Agile which work through sprint retrospectives should be applied to the ITSM processes, which allows process improvement as well as organizational learning. The principle of continuous improvement is made much more powerful by DevOps principles of full automation and collective ownership to eradicate functions and manual handover. Testing, deploying, and monitoring things automatically create workflows that are more repeatable and consistent. So they will also elevate process maturity. At the same time, as everyone feels responsible for the service, everyone will seek improvements continuously, so the process of improving will also happen here. The rapid learning cycles, coupled with the enabling technical practices form a virtuous cycle of continuous improvement. Each iteration builds on the last. This is why the maturity curve of model B is dramatically steeper than the traditional sequential approach.

## Conclusion

According to the manuscript, the IT Service Management education should be modernized by infusion of contemporary Software Development Disciplines. By developing a strong MATLAB simulation framework, we have created a quantitative assessment tool that clearly demonstrates the operational benefits of combining Agile and DevOps practices with traditional ITSM principles. The results support the notion that processes can get matured faster, more change successes will happen, and higher efficiency in incident resolution will occur after adoption of evidence-based change. This study opens multiple avenues for further research in future. For future studies, more longitudinal studies should be conducted to track the career outcomes of ITSM students after integrated education. In addition, the performance of the students may also be studied in the industry. Also, future studies may develop the simulation model further to include other organizational dynamics like inter-team dependencies, hybrid cloud, and security compliance.

The creation of specialized simulation modules on particular industry sectors like healthcare IT, financial services, or government might yield valuable domain-specific insights. A high-impact qualitative research area further concerns the change management and cultural dimensions of ITSM-DevOps integration transformations. The MATLAB code associated with this paper gives educators an immediate resource for developing experiential learning environments that allow students to bridge theory with practice. Students can know the ITSM principles and learn to experiment with the process optimization strategies in a safe simulation environment. Using this integrated educational framework, academia can develop a new generation of IT professionals with holistic skills to drive digital transformation in ever-more-complex technological environments. The impact of this change on ITSM education will help educe the long-existing gap between academia and industry, enabling the graduates to lead and innovate in the ever-evolving landscape of ITSM (Information Technology Service Management).

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