Teaching Case
Central University Medical Center: A Proposed Paperless Patient Registration System

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ABSTRACT

Using a paperless patient registration project, this teaching case demonstrates an application of the six-step approach in developing a business case for an IT investment. More specifically, this case familiarizes students with the process of developing a solid business case by defining business drivers and investment objectives, identifying and structuring benefits and costs, and estimating return on investment (ROI) based on these values. Students learn, step-by-step, the process from raw data collected from organizational records and internet research to complete managerial decisions based on detailed analysis.

Keywords: Teaching case, Information technology investment, Paperless migration, Return on investment (ROI), Total cost of ownership

1. CASE SUMMARY

Central University Medical Center (CUMC), a large academic medical center, is planning to invest in a paperless patient registration system. You will follow the six-step approach outlined in Ward et al. (2008) to identify, classify, and value benefits associated with this investment, identify and value costs that will be incurred, and perform a total return on investment (ROI) calculation. To value benefits and costs accurately, professional judgment and detailed calculations are required. Please read the case background (section 2) and proposed system summary (section 3) closely, as they provide appropriate information and necessary numerical estimates for you to complete each section of the case analysis. Pay special attention to the various systems utilized and any costs or benefits they could entail. The case requirements (section 4) highlight each deliverable you must complete.

2. CASE BACKGROUND

Central University Medical Center (CUMC) is a world-class, patient-centered, integrated academic medical center and one of the nation's premier centers for excellence in clinical care, biomedical research, and medical education. Located in the heart of Cincinnati, Central University Medical Center is composed of four hospitals – East Hospital, its flagship acute care facility; South Rehabilitation, a physical medicine center focusing on high-quality care and prompt recovery; West Hospital for Joint Diseases, the Medical Center's dedicated inpatient orthopedic hospital; and North Children's Hospital, a comprehensive pediatric hospital supporting a full array of children's health services across the Medical Center. Also, part of the Medical Center is Central University Medical School, which has trained thousands of physicians and scientists who have shaped the course of medical history, and Sloan Cancer

Center, a National Cancer Institute–designated cancer center. The Medical Center's mission is to serve, teach, and discover, which is achieved through the seamless integration of a culture devoted to excellence in patient care, education, and research.

In the last decade, the healthcare industry has experienced rapid development of digital transformation.[1] The demand for greater productivity and delivering patient-centric care is driving digital transformation in healthcare. Computerized physician order entry (CPOE), telemedicine, AI-enabled medical devices, and electronic health records (EHR) are just a few examples of digital transformation in healthcare. The IT strategy for CUMC is "continuous improvement." Ross Anderson, CIO of CUMC, says focusing on unifying expansions within the enterprise through continuous technology improvement helps facilitate any following clinical integration. This is CUMC's IT strategy for success. In fact, CUMC recently went live on its electronic health record (EHR) system, which lays the foundation for future innovation and integration. With its technology infrastructure largely in place, the hospital is planning to implement other potentially successful technologies to become completely paperless.

Paperless patient registration is an ongoing and essential development in the healthcare industry. A successful example is the NYU Langone project, which was selected as the 2017 HIMSS Enterprise Davies Award recipient (NYU Langone Health, 2017). According to the Healthcare Information and Management Systems Society, the term "completely paperless" means the hospital will no longer use paper charts in its inpatient and ambulatory settings (HIMSS, 2021). Paperless patient registration is a priority of the overall digital patient experience initiative at CUMC. The current registration process at CUMC is similar to most hospitals and clinics across the country – patients are handed a clipboard with blank forms to fill out before they can be treated (Figure 1). Thanks to a generous gift made by an influential donor, CUMC has sufficient funds to revamp its registration process, making it completely paperless.

The donor has been battling a terminal disease and has received treatment from CUMC for some time. He observed the abundance of time he wasted filling out the same forms over and over again, sometimes multiple times in a single day. He didn't understand why CUMC didn't "know" what forms he had already filled out and wondered why there wasn't a system in place as opposed to the tedious paper forms he was asked to fill out each time he came in for an appointment. He also did not understand why he had to fill out each form with his name and birthday – the same information he provided when he made the appointment. The donor made a five-million-dollar donation to transform the tedious experience of registering for medical care for all future patients. He also reached out to his colleagues at TabletKing, a major tablet manufacturer, and the CIO of CUMC to get them connected.

Without delay, the CIO of CUMC invited Guru Software to join the effort to improve the patient registration experience. CUMC has been a longtime customer of Guru Software, which designs and maintains CUMC's information management system, InfoMedical. Guru's CTO formed a project team immediately and gave the team a 30-day timeline to provide an initial solution to CUMC. Guru has rich resources and a clear high-level scope (with some ambiguity on details surrounding requirements) but a very strict timeline because the donor only has a few months to live. Through daily collaboration, Guru Software, CUMC, and TabletKing create a solution that is ready for CUMC to test and approve.

3. THE PROPOSED PAPERLESS PATIENT REGISTRATION SYSTEM

CUMC's proposed paperless registration system is a tablet-based solution to be coordinated with its existing information management system, electronic health records (EHR) system, registration software, and document management system (Figure 2). With the new tablet-based solution, patients walk into registration to complete the check-in process prior to admission. First, a registrar creates a barcode and scans it on the tablet to bring up a patient's records from TopEHR (CUMC's electronic health records system) and hands the tablet to a patient to fill out the forms. The barcode has a unique language identifier and ID, so it identifies a specific patient and displays all forms in the system that requires his/her signature. It knows if he/she had already filled out forms during past visits and presents only the forms he/she needs to complete. It also prepopulates any information that is already stored in the system, such as name, DOB, address, and any information that is collected via Health Level 7 (a set of international standards used to transfer and share data between healthcare providers).
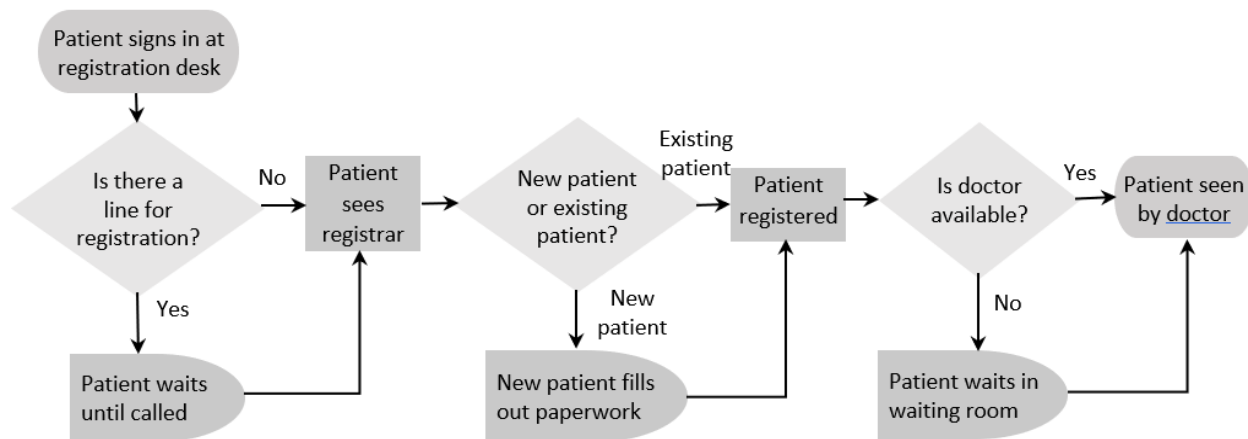

Figure 1. Generic Paper-Based Patient Registration Process (As-Is) (Patterson, n.d.)

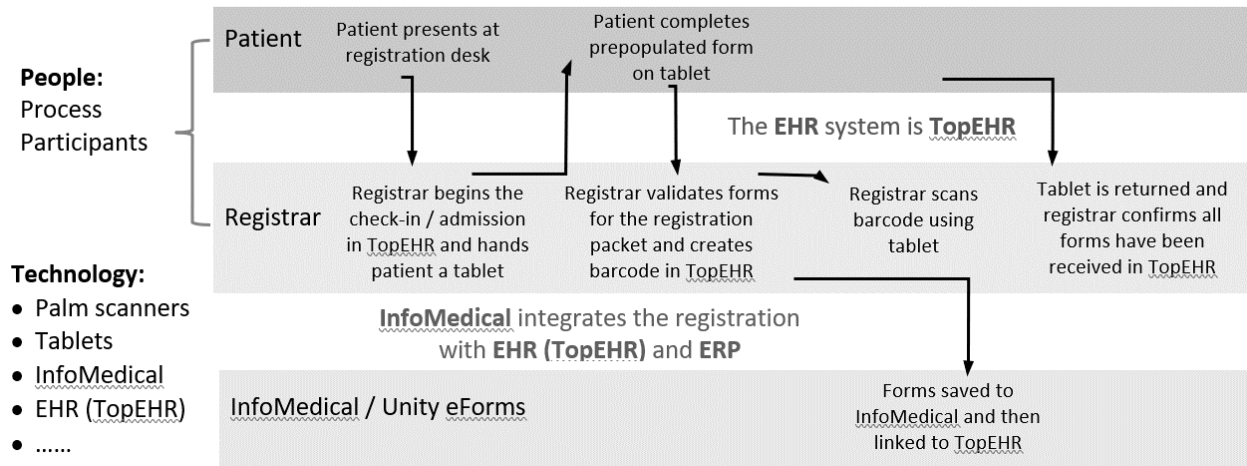**Process:** Paperless Registration Workflow

Figure 2. Central University Medical Center Paperless Patient Registration Process (To-Be) (Ostrow & Grygus, 2017)

Figure 2 depicts the process (workflow) of paperless patient registration at CUMC. Technologies used are:

- InfoMedical is the healthcare information management platform (software product by Guru).
- The tablet is what the registration forms are displayed on.
- TopEHR is the EHR (Electronic Health Records). InfoMedical integrates with the EHR (TopEHR) to make this a seamless process.

The proposed paperless system will interface with the registration system to prepopulate the patient's name and other information on the forms which are presented to the patient on a tablet. The system will present the patient with only the forms that have not been previously completed or are expired and must be renewed. It should also eliminate the scanning and indexing registrars previously had to do with a paper-based registration process. The system will employ a paperless patient registration application module developed by Guru Software[2] to be fully integrated with CUMC's current electronic heath records (EHR) system.

3.1 About InfoMedical by Guru
InfoMedical is a healthcare information management solution that helps organizations manage documents and data to streamline business operations. Integrating with business applications, InfoMedical provides seamless access to information required to perform business functions. It is designed to meet the needs of individual departments while collectively managing the content for the enterprise. InfoMedical provides access from desktops or mobile devices, and it can be deployed on premises or in the cloud. Healthcare organizations including CUMC use InfoMedical to complete patient records, eliminate reimbursement delays, and aid business processes.

3.2 About TopEHR
TopEHR is one of the largest providers of health information technology, used primarily by large U.S. hospitals and health systems to access, organize, store, and share electronic health records (EHR). The company has a reputation as a technological leader for both its products and related installations. TopEHR's offerings integrate across a variety of settings and functions. Two of the company's prominent products and services are: (1) EHRCare, the core EHR product, tailored for physicians and organizations and focusing on clinical care, decision support, and streamlined processes; and (2) MyRecord with patient engagement features, including family health information. According to Guru Software, InfoMedical integrates with more than 30 TopEHR modules and many other applications to boost user adoption while extending the value of existing IT investments across the organization. CUMC currently has multiple TopEHR application modules integrated into its InfoMedical information management system.

3.3 InfoMedical and TopEHR Integration
For CUMC's paperless patient registration project, Guru Software developed a MobilEnter application to be embedded into the InfoMedical system to provide seamless integration with TopEHR's electronic health records modules. InfoMedical pre-populates the digital registration forms with the patient information already found in the EHR. Example data includes a date of birth, address, phone number and insurance information. Patients only need to provide information that has not yet been entered. Due to seamless integration with TopEHR, basic analytics about number of registrants, time of registration, and registration errors are also a part of the system. Guru also integrated a live "help" feature in the paperless registration system that allows patients to connect with a staff member if they have any questions about the forms.

4. CASE REQUIREMENTS

You are a student intern in the CIO's office at CUMC. Your boss heard that you know how to develop robust business cases for IT initiatives using the six-step approach, so he charges you to develop a business case for the proposed paperless patient registration project. You will present your case to upper management, including the CEO and CFO, for them to evaluate and approve the project. The CFO specifically requires a clearly computed and explained ROI calculation based on your research and specific estimates of potential benefits, costs, and potential risks. Since you would like to land a job at CUMC, this business case is crucial to you as well as the organization.

You will apply the six-step approach (Ward et al., 2008) along with the Total Cost of Ownership (TCO) framework (Wise, 2012) to develop your business case. The six-step approach will help you identify the benefits, costs, risks, and return on investment in a thorough and comprehensive fashion. You will base your business case on data collected from paperless patient registration projects recently completed by other medical centers and hospitals. Figure 3 presents a partial sample of cost and benefit components collected from a similar project recently completed by a medical center. Other benefits and costs not given in Figure 3 can be included in your case via research and estimation. Building your business case on a previously completed successful project makes your case more realistic, precise, and rigorous.

In addition to the cost and benefit components disclosed in Figure 3, you will use the following cost and benefit assumptions:

- The cost of the solution upfront is $400,000 in software, with a 20% maintenance charge which will be paid by CUMC to the software development firm on a yearly basis. The Total Cost of Ownership (TCO) approach can help identify other possible costs.
- The proposed solution will cut registration times by 64% from 11 minutes to 4 minutes, on average.
- Because of this technology, the CUMC will save up to 200 sheets of paper per day that are now manually scanned and indexed into the system. CUMC estimates that each year they will save the following in paper after they roll out the proposed system:
  - East Hospital – $100K
  - South Rehabilitation – $100K
  - West Hospital for Joint Diseases – $125K
  - North Children's Hospital – $25K
  - Sloan Cancer Center – $50K
- CUMC will need 6 servers deployed for all divisions. Computer servers for hosting the proposed system are about $30,000 per server per year.
- There will be about 100 tablets deployed for each hospital and they have five hospitals. The tablets they purchase for this project will be $500 each. Ten percent of the tablets will be replaced each year.
- They will eliminate 3 full-time equivalents (FTEs) in scanning and indexing, as well as an additional $93,000 of courier costs per year.

In order to comprehensively present this business case to the CEO, CFO, and other top-level managers, you must fulfill and submit the following case requirements:

Requirement No. 1. Read Ward et al. (2008) to familiarize yourself with the six-step approach to developing business cases.

Requirement No. 2. Read Chapter 11 of Wise (2012) to understand the total cost of ownership (TCO) framework.

Requirement No. 3. Review step one (business drivers and investment objectives) of the six-step approach from Ward et al. (2008). After doing so, identify and describe one or more external and one or more internal business drivers for this case. Then, identify two or more broad investment objectives of the new paperless process.

Requirement No. 4. Review step two (benefits, measures, and owners) of the six-step approach from Ward et al. (2008). After doing so, identify 10 or more benefits of implementing the new registration system and document them and any relevant details using Ward et al.'s (2008) table (Figure 1 of their paper). Within each table cell, you may include more than one relevant benefit. In the table cells, you must describe each benefit, identify an appropriate measure for each benefit, and identify a reasonable owner for each benefit. Then, make a second table listing out each benefit and calculate the corresponding estimates used to quantify (or qualitatively assess) those benefits. Keep in mind that some benefits (mostly financial) are explicitly listed in the case details while some require your creativity and critical thinking skills.

Requirement No. 5. Review steps three and four (structuring benefits and identifying organizational change) of the six-step approach from Ward et al. (2008). After doing so, separate the benefits based on the categories doing new things, doing things better, and stop doing things. Also describe why each benefit belongs in its designated category.

Requirement No. 6. Review step five (determining the explicit value of each benefit) of the six-step approach from Ward et al. (2008). After doing so, separate the benefits again by type (i.e., observable, measurable, quantifiable, financial) and identify a plan to measure the explicit value of each benefit to the hospital. These plans should include appropriate calculations if possible (e.g., quantifiable, financial) and should be very detailed if calculations are not possible (e.g., observable, measurable).

Requirement No. 7. Review step six (identifying costs and estimating ROI) of the six-step approach from Ward et al. (2008). After doing so, make a table listing out each cost (separate direct and indirect costs) and calculate the corresponding estimates used to quantify (or qualitatively assess) those costs. Then, develop a spreadsheet (based on the sample in Figure 3) to calculate the return on investment (ROI) using the quantified values of costs and benefits you developed earlier. You may not have identical categories of costs and benefits as in Figure 3, but it is your task to develop an appropriate spreadsheet calculating the ROI for this business case. You may choose to exclude the non-quantifiable costs and benefits in this calculation or, if possible, reasonably estimate a value for each of them. Finally, discuss the numbers you calculate in the spreadsheet and draw any necessary conclusions regarding the financial viability of this investment.

Requirement No. 8. Lastly, draft a short conclusion discussing each of steps you performed and the implications of the ROI for the case. Keep in mind, this conclusion should clarify any possible questions or concerns that management would have and provide your best interpretation for the cost-benefit analysis of the case. You must think in the mindset of

the hospital's management team (especially the CFO) to address any potential worries or objections they could have regarding your approach to developing the case, your estimations and calculations, or your conclusions about the viability of the investment. Potential risks, issues, major decisions, and impacts to the employees in terms of Organizational Change Management (OCM) should be considered when trying to decide whether to undertake this investment.[3] Also, be sure to provide a final definitive recommendation to the management team regarding whether they should proceed with the proposed plan for this investment.

The ROI calculation in Figure 3 is based on the information given in the case description.

- The cost of the solution upfront was $400,000 in software, with a 20% maintenance charge which will be paid by CUMC to Guru on a yearly basis. Total Cost

of Ownership (TCO) approach can help identify other possible costs.
- They estimate the following paper cost savings after implementation of the paperless system:
  - East Hospital – Savings of $100K in paper savings/year
  - South Rehabilitation – Savings of $100K in paper savings/year
  - West Hospital for Joint Diseases – Savings of $100K in paper savings/year
  - The dedicated inpatient orthopedic hospital - Savings of $25K in paper savings/year
  - North Children's Hospital - Savings of $25K in paper savings/year
  - Sloan Cancer Center - Savings of $50K in paper savings/year

Direct Costs		Year 1 Pilot	Year 2	Year 3	TCO Life Cycle
Software costs	InfoMedical software (upfront and maintenance)	$ 400,000	$ 80,000	$ 80,000	$ 560,000
	other software related costs				$ -
Hardware costs	Servers				$ -
	Tablets				$ -
Management costs					
Support	help desk and training expenses				$ -
Total Direct Costs		$ 400,000	$ 80,000	$ 80,000	$ 560,000

Indirect Costs	Year 1 Pilot	Year 2	Year 3	TCO Life Cycle
Business change costs				
Downtime costs				
Other indirect costs				
Total Indirect Costs				

Total Costs	$ 400,000	$ 80,000	$ 80,000	$ 560,000

Financial Benefits	Year 1 Pilot	Year 2	Year 3	TCO Life Cycle
Stop Doing Things				
Stop using paper forms and related activities	$ 400,000	$ 400,000	$ 400,000	$ 1,200,000
Doing Things Better				
List benefits you identified in this category				
Doing New Things				
List benefits you identified in this category				
Total Financial Benefits	$ 400,000	$ 400,000	$ 400,000	$ 1,200,000

ROI - $	$ -	$ 320,000	$ 320,000	$ 640,000
ROI - %	0%	400%	400%	114%

ROI/Year	$213,333

Figure 3. Initial ROI Calculation for Demonstration (Sharepointeurope, 2010; Wise, 2012)

5. ENDNOTES

[1] According to Salesforce (2022), "Digital transformation is the process of using digital technologies to create new or modify existing business processes, culture, and customer experiences to meet changing business and market requirements."

[2] For more information about paperless patient registration, visit websites of market-leading Health Information Management solutions, such as OnBase by Hyland (https://www.hyland.com/en/healthcare/content-services/health-information-management/paperless-patient-registration). While there are alternatives and competitors of OnBase software, OnBase is a safe choice of Enterprise Content Management (ECM) software platform since Hyland Software has been named as a leader in Garner's Magic Quadrant for ECM for 12 years. Other leaders in ECM are, Microsoft, Box, and OpenText.

[3] According to a Deloitte Insights article by Appleby et al., (2021), cybersecurity is the main risk when it comes to healthcare digital transformation. In addition, privacy and security of patient information are among the high-risk issues for paperless patient registration. By their nature, digital transformations (such as paperless patient registration) interrupt the internal continuity of a healthcare organization until the new system acquires momentum. Organizational Change Management (OCM) can minimize the interruptions and decreases the time required to realize productivity gains from transformation.

6. REFERENCES

Appleby, C., Hendricks, J., Wurz, J., & Shudes, C. (2021). *Digital Transformation: From a Buzzword to an Imperative for Health Systems*. Deloitte Insights. https://www2.deloitte.com/us/en/insights/industry/health-care/digital-transformation-in-healthcare.html

HIMSS. (2021). *Electronic Medical Record Adoption Model.* Healthcare Information and Management Systems Society. https://www.himssanalytics.org/emram

NYU Langone Health. (2017, September 14). *NYU Langone Awarded HIMSS Enterprise Davies Award for Excellence in Health Information Technology*. NYU Langone Press. https://nyulangone.org/news/nyu-langone-awarded-himss-enterprise-davies-award-excellence-health-information-technology

Ostrow, D., & Grygus, G. (2017, February 19). *Paperless Registration* [Conference Session]. HIMSS Global Health Conference & Exhibition 2017, Orange County Convention Center, Orlando, FL, United States. https://careersdocbox.com/Nursing/82881637-Paperless-registration.html

Patterson, K. (n.d.). *Patient Registration Process Flowchart*. Creately. https://creately.com/diagram/example/iqzlqi0u1/Patient%20Registration%20Process%20Flowchart

Salesforce. (2022). *What Is Digital Transformation*. https://www.salesforce.com/products/platform/what-is-digital-transformation/?d=nav-prev

Sharepointeurope. (2010). *ROI of Building a Company-Wide Video Podcasting Portal Using Microsoft SharePoint Server*. https://www.sharepointeurope.com/media/60442/microsoft%20academy_return%20on%20investment%20(roi)%20white%20paper.pdf

Ward, J., Daniel, E., & Peppard, J. (2008). Building Better Business Cases for IT Investments. *MIS Quarterly Executive,* 7(1), 1-15. https://www.researchgate.net/publication/42795352_Building_Better_Business_Cases_for_IT_Investments

Wise, L. (2012). Evaluating ROI and TCO. *In Using Open Source Platforms for Business Intelligence* (pp. 117–127). Morgan Kaufmann Publishers. https://vdoc.pub/documents/using-open-source-platforms-for-business-intelligence-avoid-pitfalls-and-maximize-roi-64a4dni9sec0
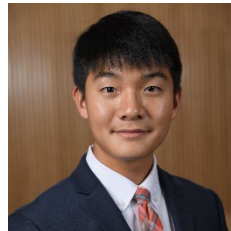
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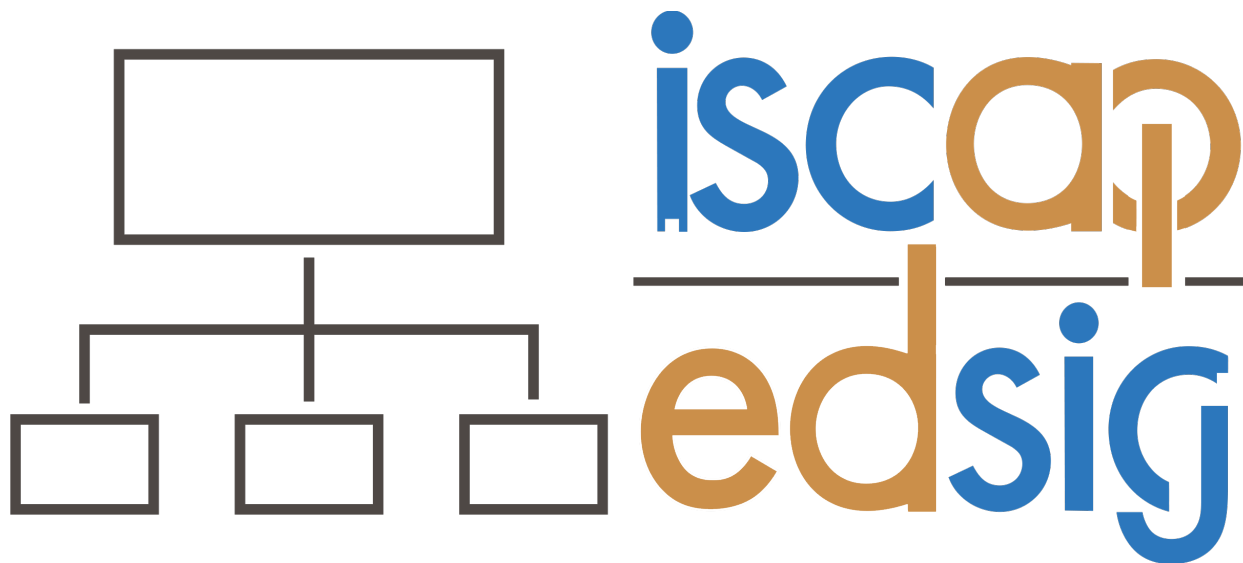
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