Consumption-based Supply-Chain: Healthcare Materials Management using Microsoft Dynamics GP and Binary Stream Add-on Software

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Abstract: Healthcare Materials Management (HMM) can be defined as a process that requires product (material) flows to meet the patient care needs in hospitals. HMM functions consist of procurement, distribution, and inventory control of supplies while providing high quality care at reduced cost. In this article, we provide a summary of instructional guideline for teaching HMM in an undergraduate course using Microsoft Dynamics-GP with healthcare materials management add-on functions created by *BinaryStream*. It is expected that these hands-on assignments will be useful for undergraduate majors in General Business, Management, Supply-Chain Management, Health Information Management, and Business Information Systems.

INTRODUCTION

Healthcare Materials Management (HMM), after years of being seen as a required but secondary function in the healthcare industry, is recognized as cost saving, quality improving operation as well as a clinical and financial performance imperative. In the past, the primary focus of the healthcare providers was to provide high quality of care regardless of cost, however, in the event of intense competition and cost increase, HMM has gained importance. Studies have shown that between 1/3 and ½ of hospital expenses are invested in various HMM (Jarousse & Lazar, 2011), and that a significant amount of the costs associated with materials management could be saved by appropriate use of software and best practices (Minahan, 2007).

All segments of a hospital such as, Purchasing department, stores, the pharmacy, patient care units, emergency department, and operating rooms are involved directly or indirectly in the healthcare supply chain (materials management) process. In most hospitals, opportunity for cost saving exist since healthcare operations require hundreds of tools and supplies resulting in a fragmented internal supply chain process. For example, medical and office supplies are managed by one department, the pharmacy purchases pharmaceutical products separately, and food services manages the procurement and processing of food products.

From within an organization's viewpoint, HMM is a quite different from the typical supply-chain process. While a typical supply-chain process involves stock items that are shipped directly from the vendor to a warehouse, the healthcare supply-chain is mostly a consumption-based process. Certain products (inventory products) are stocked before being distributed to specific departments while the majority non-stock (non-inventory) items are ordered directly by specific departments and are delivered to them upon receipt of those products.

Pharmaceutical products, on the other hand, are divided into two main categories: general products and prescription drugs. The inventory and non-inventory distinction doesn't apply to pharmaceuticals because all requisitions must go through the pharmacy (Poulin, 2007).

Therefore, by nature, HMM is different from the traditional materials management in many other industries. While not exhausted, some noticeable differences are (adapted from Tonzetich, 2012):

- HMM is mostly consumption-based, not distribution-based
- In HMM, inventory is not sold, it is consumed (inventory is issued)
- "Consumers" (i.e., customers) of health care materials are within the organization – they are clinicians (e.g., physicians, nurses) and patients requiring health care materials
- Not all materials managed by HMM have 'positive' stock balances
- Inventory level is normally set to an arbitrary level (PAR level)
- Centralized Purchasing / Materials consumption workflow
- Healthcare industry are mostly multi-company/multi-entity Environments

Healthcare industry does realize that HMM is a significant cost segment and better materials management can benefit their bottom line by streamlining the supply-chain process and strategically aligning HMM with the organization's mission and strategic vision. In addition to cost reduction and process improvement, appropriate software based Materials Management may be able to:

- reduce inventory level (increase inventory turnover)
- improve inventory accuracy and provide consumption statistics
- ensure accuracy in billable patient materials
- make sure that patient billing are sent to the Billing department

The purpose of this paper is to provide a guideline for development and delivery of HMM topics in an undergraduate Health Informatics course in which in-depth experiential learning is provided using Microsoft Dynamics Great Plains (GP) and Healthcare Materials Management System (HMMS) developed by *BinaryStream*. *BinaryStream*'s HMM contains many add-on functions to the existing MS GP 2010 software. Traditionally, MS Dynamics-GP is a distribution-based Supply Chain solution. Binary Stream adds many healthcare supply chain/materials management functions (add-ins) on top of GP. Benefits of teaching materials management using ERP software are many (adapted from Sweeney, *et. al*, 2010);

- Students receive hands-on real-world experience of using a commercial software in the classroom
- Employers benefits from hiring students who are familiar with supply chain process and appropriate software
- Software vendors benefit from student exposure to their products as students graduate and become potential future users of their software
- Instructors benefit from increased opportunities for applied research at their institution, increased visibility in the business community, and chance to collaborate with the business community in classroom experiential learning.

In the next section a framework of the teaching materials, in specific, a step-by-step guideline is presented, followed by a conclusion in the final section.

HEALTHCARE MATERIALS MANAGEMENT PROCESS (HMMP)

The overall learning objectives of HMMP are:

- Understand healthcare materials management process, especially, inventory management, vendor management, site management, purchasing, receiving, and invoicing.
- Comprehend the configuration process in ERP software for successful use of materials management.
- Apply management and decision making aspects in materials management.
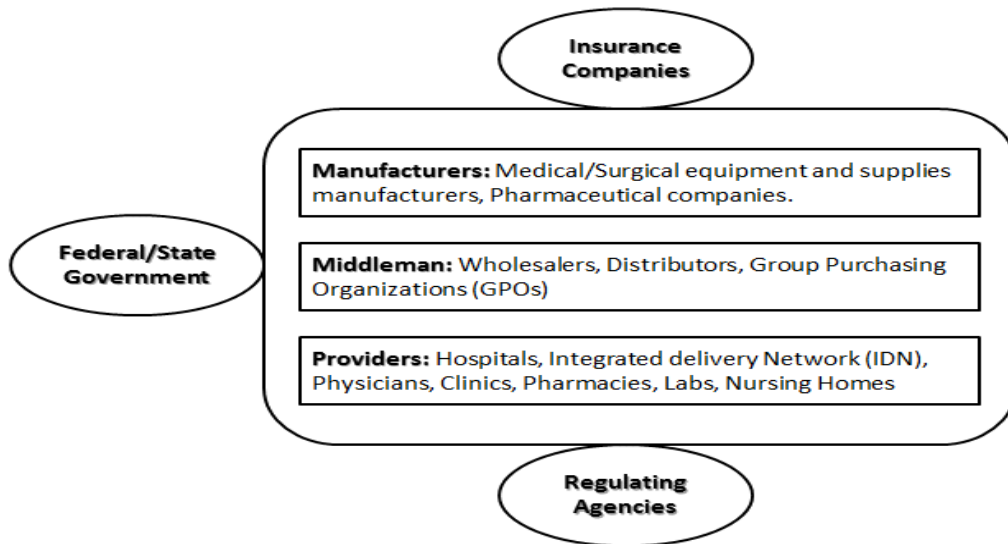
Step 1: Introduction of HMM Stakeholders

Figure 1: HMM stakeholders (adapted from Callender, 2007)

Step 2: Discussion of HMM Process with a flow diagram of the Product and Information Flow
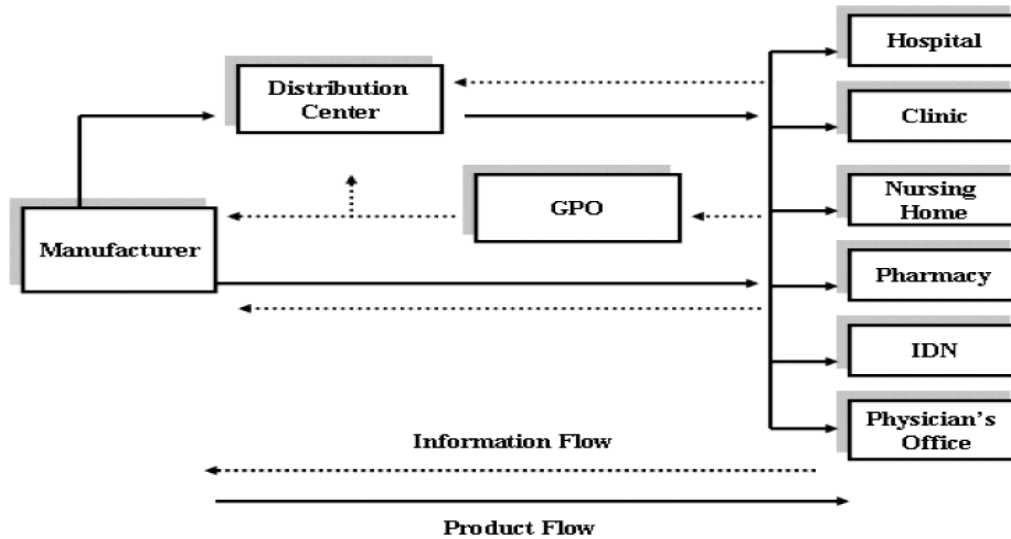

Figure 2: HMM product and information process (Callender, 2007)

Step 3: Setting up Item and Site maintenance for Inventory management

A number of key configuration tasks must be completed first.

1) **Item Maintenance** (***Hands-on Lab Component***)**:** For inventory items, units of measure types apply to purchasing, issuance and patient charges. Items can be stored as stock or non-stock items and attribute related to a healthcare item such as expired item can be tracked and customized as needed. Items may be identified as patient

trackable and chargeable. Patient Charge Codes and Patient Charge schedules are available for enhanced billing workflows in the *BinaryStream* add-on functionality in GP (see Figure 3)

Figure 3: Item maintenance (Tonzetich, 2012)

Along with Item number and description, following parameters need to be set for HMM Vendors have to be set in order to attach a vendor with an item. Other related maintenance operations, for example, unit of measure (UOM), product category, group code, etc. have to be done prior to setting up items in the systems.

- Unit of Measure (UOM)
- Stock and Non-stock items
- Patient related parameters, which include:
    - Patient Trackable/Chargeable
    - Patient Charge Code
    - Patient Price Formula
    - Patient Charge Formula

- Vendor

2) Site Maintenance (*Hands-on Lab Component*):

Figure 4: Site maintenance (Tonzetich, 2012)

Along with Site ID and description, following parameters need to be set for HMM (see Figure 4):

- Site Address
- Site Characteristics, which include:

    - Replenishment site
    - Par
    - Requisition

- Stock/Non-stock

3) Par List Maintenance (*Hands-on Lab Component*): Par list is the master list of all the items in a site. Following parameters have to be set for items in the list (see Figure 5):

- Par
- Requisition
- Generic Location
- Replenishment Site
- Stock or not

Figure 5: Par list maintenance (Tonzetich, 2012)

Step 4: Purchase Management (*Hands-on Lab Component*)

Purchasing is the process of buying goods and services. Steps of purchasing process include identification of demand (amount or quantity needed) for one or more items for a specific period, evaluation of suppliers, selection of suppliers, creating purchase orders, receiving items, and measuring and managing supplier performance. These stages generally vary by organization and type of items purchased. Characteristics of *BinaryStream*/GP Purchasing Management are (Tonzetich, 2012):

- Different PO Types can be established for different purchases (i.e. consumables versus capital items)
- Items can be allocated to Site, Department or Entity levels
- Capital Item POs are tracked
- POs can be transmitted in a variety of fashions such as EDI, Email, Fax and more
- Auto PO Process
- Auto Receiving

Purchasing Workflow (see Figure 6)**:** Purchasing workflow consists of following tasks (*BinaryStream*):

- Create Auto PO Preview Template
- Process Auto Preview
- Upload Inventory Count
- Process PO Preview and Create PO
- Process PO Preview, Create PO and Transmit PO
- Create a PO
- Transmit PO (if not done during PO Preview processing)
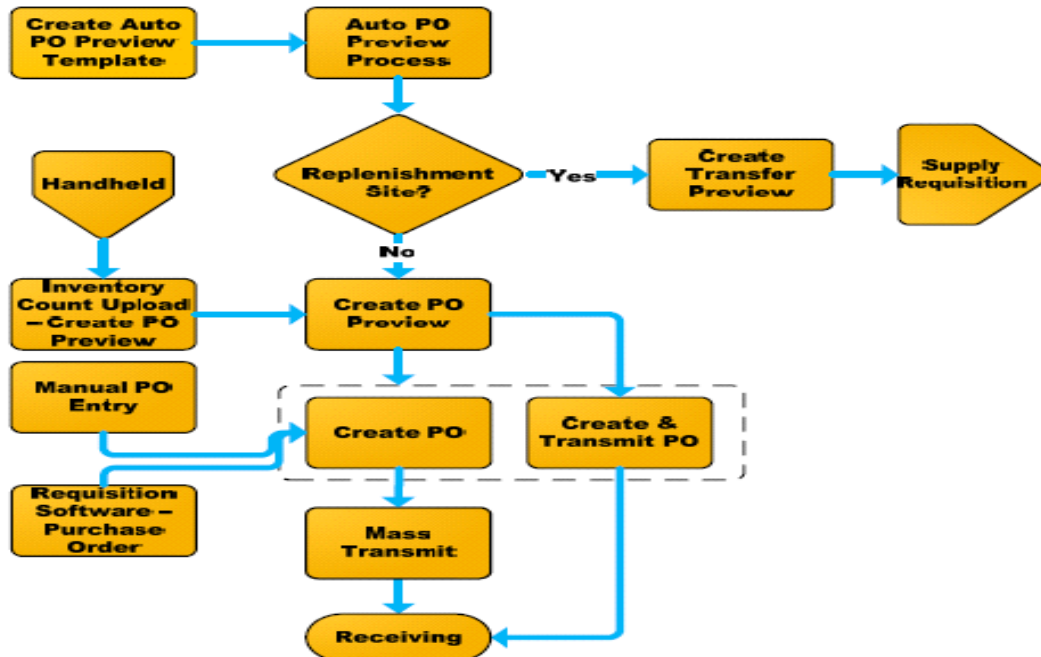
Figure 6: Purchasing workflow (*BinaryStream* User Guide, 2012)

Purchasing workflow is composed of the following key steps:

Step 4-1: Auto PO Preview Template Window (see Figure 7)
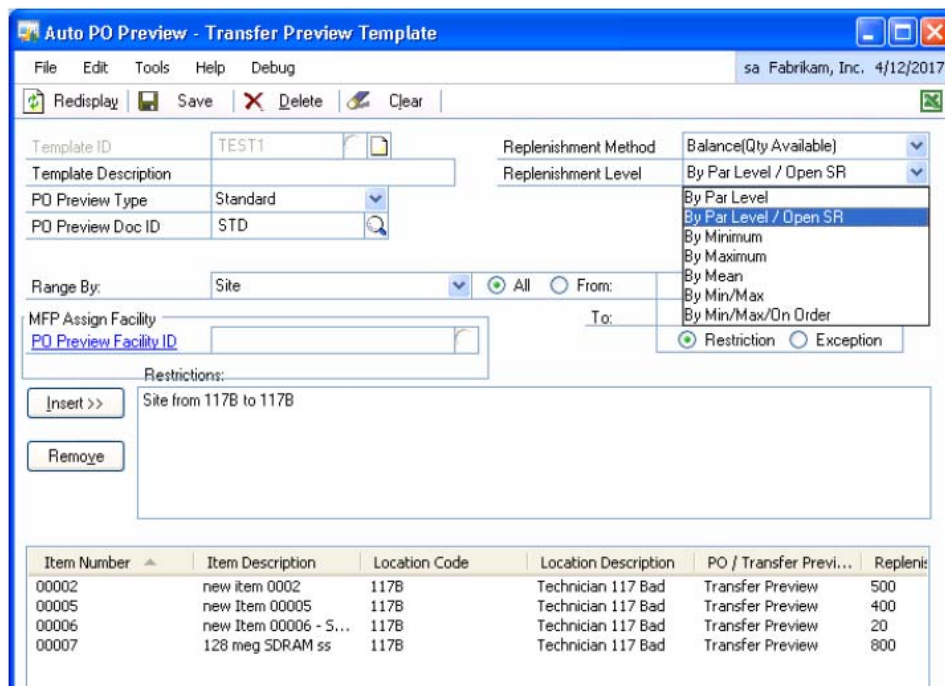
Figure 7: Auto PO preview (*BinaryStream* User Guide, 2012)

This window is used to create templates for purchasing inventory at a site. A template is processed in the Auto PO Preview–Transfer Preview Processing window to create PO Preview or Transfer Preview transactions. PO Preview Documents are created in the following conditions:

- Par List Maintenance Replenishment Site is empty
- Par List Replenishment Site for this item and site is non-stock
- Site is non-stock.

Step 4-2: The Auto PO Preview Exception Report lists data errors occurred during processing (see Figure 8).

Auto PO Preview Exception Report

| User ID : | sa | | Page # | 1 |
| User Name: | sa | | Date: | 12/7/2007 |

| Item Number	Buyer ID	Site	Error Description
033218	sa	01.94540	Primary Vendor is not setup
033301	sa	01.94540	Par Value is not Setup
RIMPY-BSSIMISC	sa	01.94540	Primary Vendor is not setup
TESTSERIAL	sa	01.94540	Primary Vendor is not setup
011764	sa	01100	Par Value is not Setup
011907	sa	01100	Primary Vendor is not setup
033299	sa	01100	Primary Vendor is not setup
033300	sa	01100	Primary Vendor is not setup
BSSI-SERIAL	sa	01100	Primary Vendor is not setup
011764	sa	02600	Par Value is not Setup
034066	sa	02600	Par Value is not Setup
033301	sa	02930	Par Value is not Setup
010966	sa	03.81400	Par Value is not Setup
MISC	sa	03.81400	Primary Vendor is not setup
MISC-7750	sa	03.81400	Primary Vendor is not setup

Figure 8: Auto PO exception report (*BinaryStream* User Guide, 2012)

Step 4-3: Purchase Order (PO) Entry Window (see Figure 9)

Purchase Order Entry window is to enter purchase orders and to modify purchase orders with New, Released, and Change Order statuses. Purchase orders that have never been printed or sent to the vendor may also be deleted or voided. In the Purchase Order Entry window, only purchase orders with New, Released, and Change order statuses can be viewed. Purchase order that has been placed on hold can be printed. Printing a purchase order on hold doesn't change the purchase order's status. It is recommended that Purchase Order Review and Purchasing Batch Entry be completed before going into the PO Entry window.
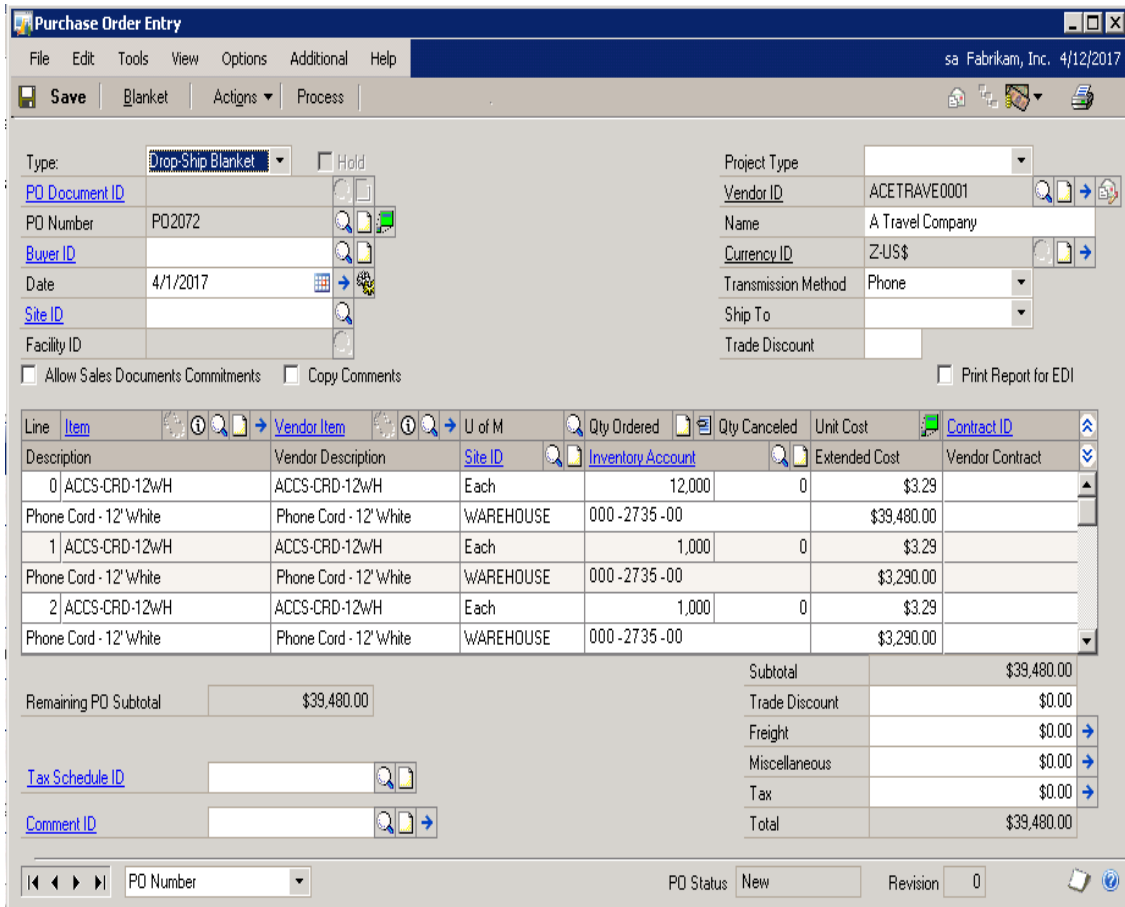
Figure 9: Purchase Order Entry

Step 4-4: Mass PO transmission window (see Figure 10, *BinaryStream* User Guide, 2012)

This window is used to select a range of Purchase orders and transmit them all at one time. Once the POs are transmitted the status is changed from **New** to **Released**. Documents can be arranged by Buyer, Document date, Facility ID, Location code, PO number and Vendor ID. Purchase orders for a range of users may also be selected. The Process button will automatically send the Purchase order via the selected Transmission Method. For example, if the transmission method is EDI, the system will automatically send the PO to the vendor using EDI functionality. For Email Transmissions, the Purchase order will be emailed via Outlook to the email address set up in the Purchasing Address of the vendor. The Purchase Order is attached as a PDF document to the email. For online Transmission Method, the Purchase Order will be processed and sent to the Vendor in cXML format (*BinaryStream* User Guide, 2012).
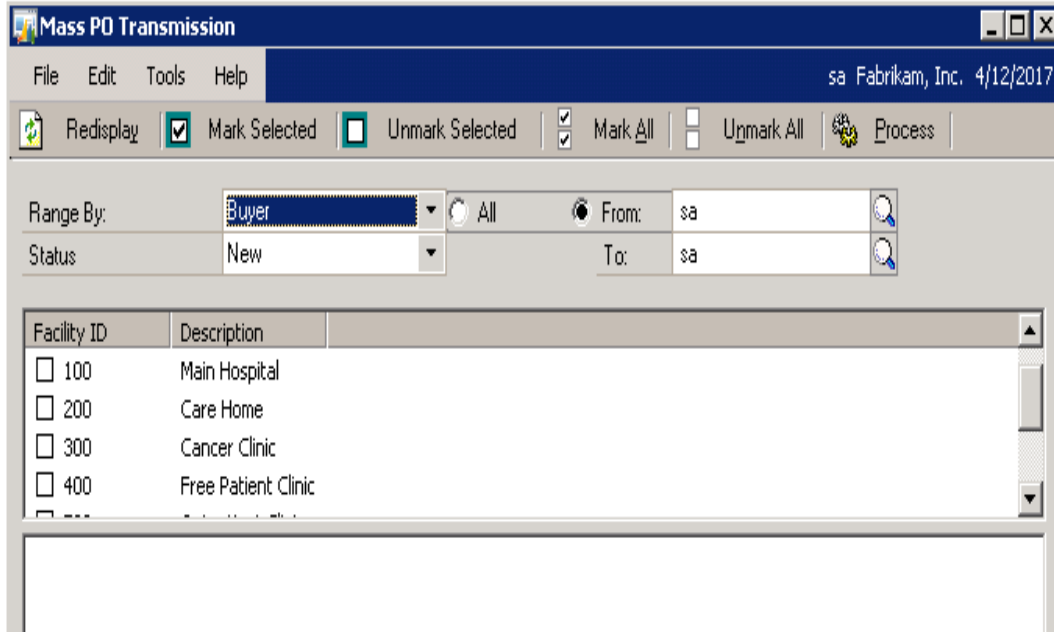
Figure 10: Mass PO transmission

Step 5: Purchase Order Process (POP) Receiving Transactions (*Hands-on Lab Component*)

Receiving Transactions are for receiving actual products shipped from vendor and to record shipment and/or invoice. A single receiving transaction may be created to include items from multiple purchase orders from a single vendor.

Receiving Workflow (see Figure 11): Receiving workflow consists of following tasks (*BinaryStream* User Guide, 2012):
- Receive PO (Receivings Transaction Entry)
- Adjust Inventory to remove quantity if PO received for non-stock site
- Print Piggyback Labels (Label Printing Process)
- In Accounting, Enter Invoice/Match to PO (Enter/Match Invoices)

Step 5-1: Receiving Transaction Entry Window (see Figure 12)

In the Receiving Transaction Entry window, one has the option of receiving items that weren't included on the original purchase order or receive items without a purchase order. Line items on a purchase order can be received automatically (Microsoft Dynamics GP, Purchase Order Processing document).

Receiving Transaction Entry window can also be used to correct shipment receipts, shipment/invoice receipts, or in-transit transfer inventory receipts before posting. One can delete or void un-posted receipts, shipment/invoice receipts, or in-transit transfer inventory receipts.

Shipment/invoice or shipment receipt for a purchase order that is on hold can't be entered. If a purchase order is placed on hold after its receipt is saved to a batch, the receipt for that purchase order will not be posted and will remain in the batch. (Microsoft Dynamics GP Help).
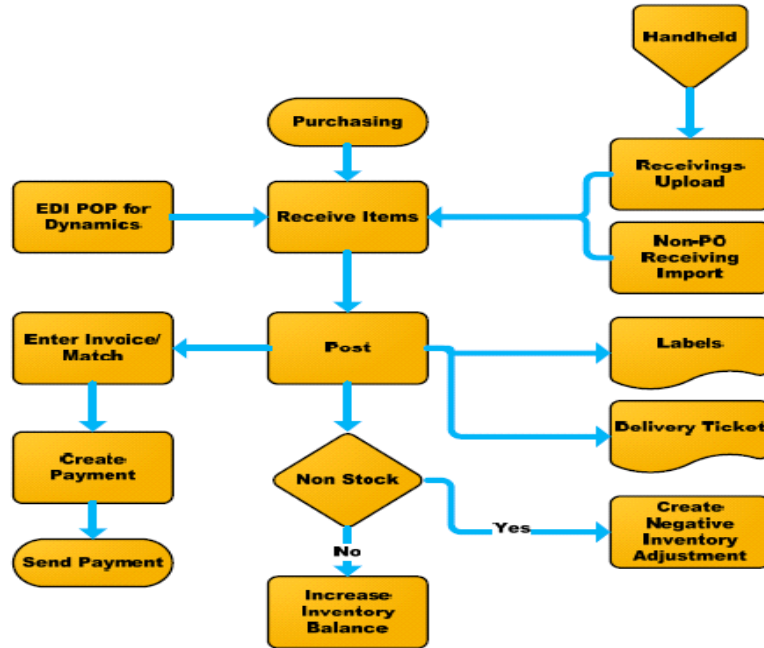
Figure 11: Receiving workflow (BinaryStream User Guide, 2012)

Figure 12: Receiving transaction entry (*BinaryStream* User Guide, 2012)

Step 5-2: Enter/Match Invoices (see Figure 13, Purchasing Invoice Entry Window)

Purchasing Invoice Entry window can be used to enter, save and post invoice receipts. Items from multiple purchase orders from a single vendor may be combined on an invoice receipt. Just as with Receiving Transaction entry, one can enter invoice receipts for items not included on the original purchase order or items not associated with a purchase order. Landed cost may be entered as line items. Purchasing Invoice Entry window may also be used for deleting and voiding unposted invoice receipts (Microsoft Dynamics GP Help).

Figure 13: Purchasing invoice entry (*BinaryStream* User Guide, 2012)

Step 6: Inventory Transactions (*Hands-on Lab Component*)

Inventory transaction allows users to create inventory issue and manage return transactions. Issue transactions are for managing consumption of inventory by departments. Issue transactions have the following key features (*BinaryStream* User Guide, 2012):

- Create Issue and Returns by department
- Update appropriate distributions based on department segment
- Create issues for 'Stock' items
- Allow issues to authorized users by department and site
- Track Patient Information

Issue functionality is built by *BinaryStreams* on top of Great Plains Inventory Transaction Entry screen. Additional details are tracked both at header and detail level throughout the life of the transaction.

Step 6-1: Item Transaction Entry Window (see Figure 14)

Item Transaction Entry window is used to issue items to a department, enter variance, manage returns, adjust inventory transactions, among others. The Document Types are adjustment, Variance, Transfer, Issue, Return, Expired, Vendor Return, Dept Trfs (transfers). This window uses the next document number and the account segment for sites set up in the Inventory Control Setup window. Each transaction must be posted individually if Batch ID is not used to group inventory transactions (Microsoft Dynamics GP Help).

Access to issue transactions is granted by selecting the Allow Issue option in the HMM User Setup window provided by BinaryStream add-in software. No General Ledger transaction is created for Issue transactions (BinaryStream User Guide, 2012).
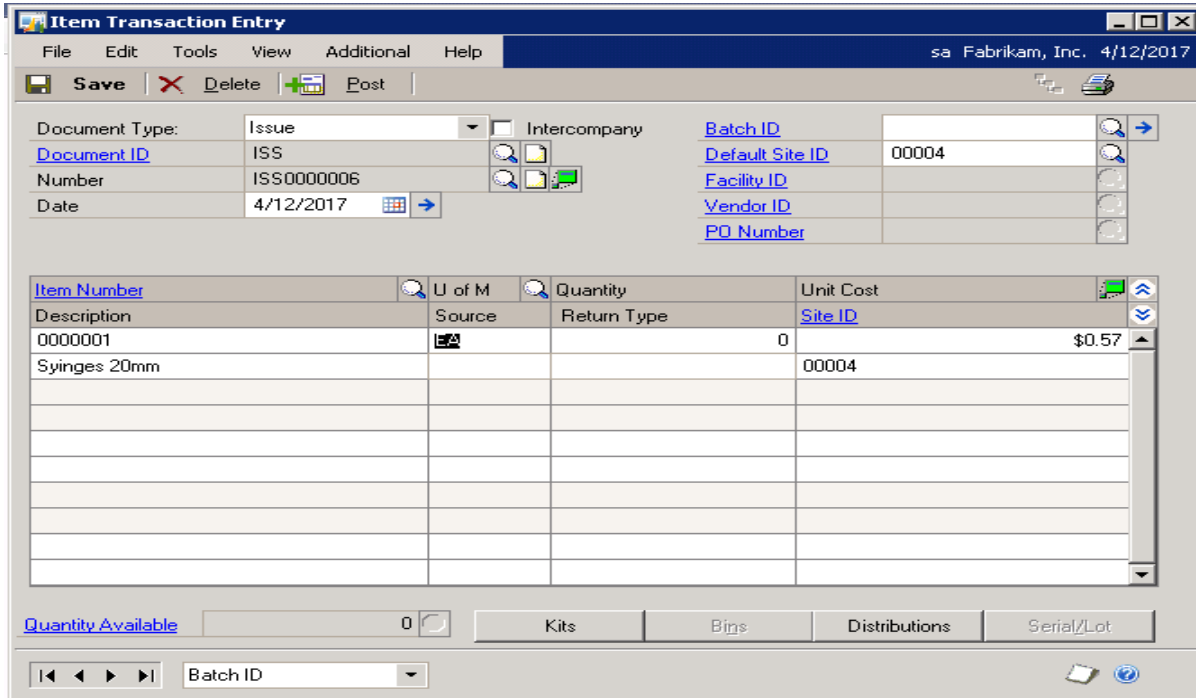
Figure 14: Item transaction entry window

Patient Tractable Button (see Figure 14)

This is the button with the green icon beside the Number and the Unit Cost Label. The Patient Trackable window (see Figure 15) will open when the button is clicked. If the item is not marked as Patient Trackable on the item maintenance window then the window will not open. The information entered on the header level will default as well as the Item Number, Item Description, Facility and Inventory Account from the line. If the issue transaction has a patient attached to it then this window will allow the user to enter information specific to that patient (*BinaryStream* User Guide, 2012).
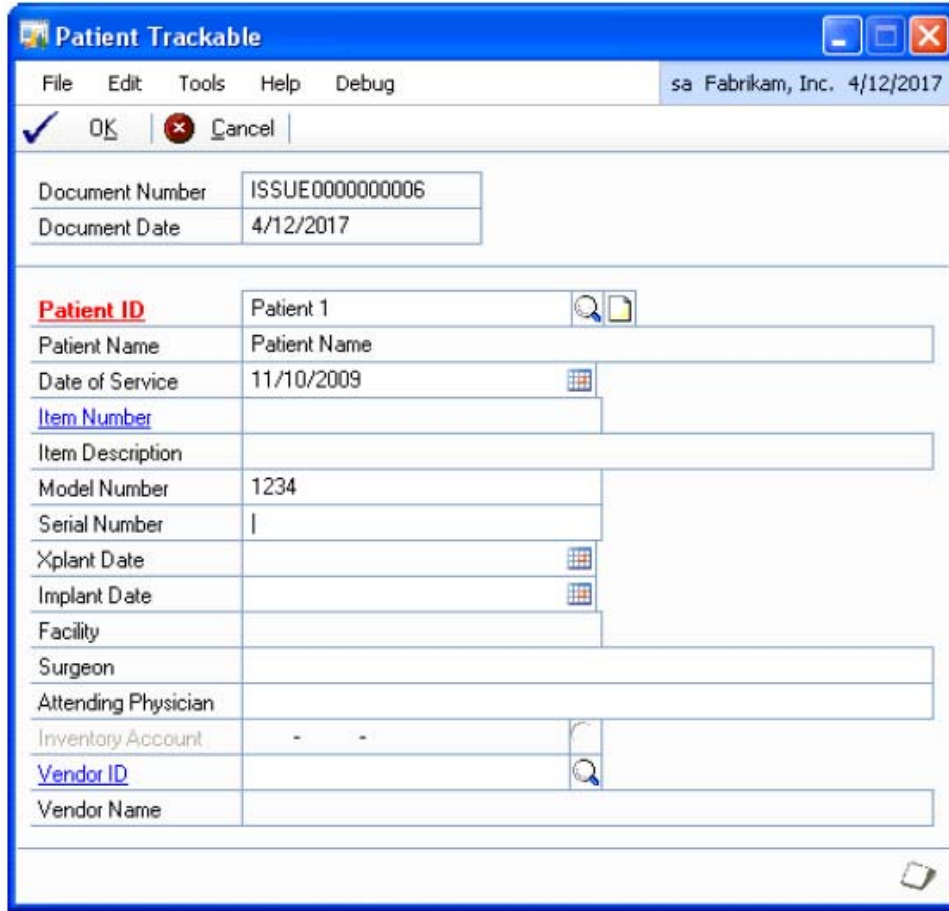
Figure 15: Patient trackable window

Step 6-2: Return Transactions (see Figure 16, *BinaryStream* User Guide, 2012)

Access to return transactions is granted by marking the Allow Return checkbox on the HMM User Setup window. The Distributions consists of a debit to the items inventory account and a credit to the items inventory offset account. The transactions cannot be posted individually; they must be posted by batch. If the return type is On Hand then when the document is posted the On Hand Quantity will be increase for this item site combination. If the Return type is not On Hand then during posting, On Hand Quantity and Allocated quantity are increased and Inventory Transfer is created. For any other return type, On Hand Quantity and Allocated Quantity are decreased and Return Type Quantity is increased.

Figure 16: Item transactions (return) window

Step 7: Inventory Tracking Form (ACME Hospital)

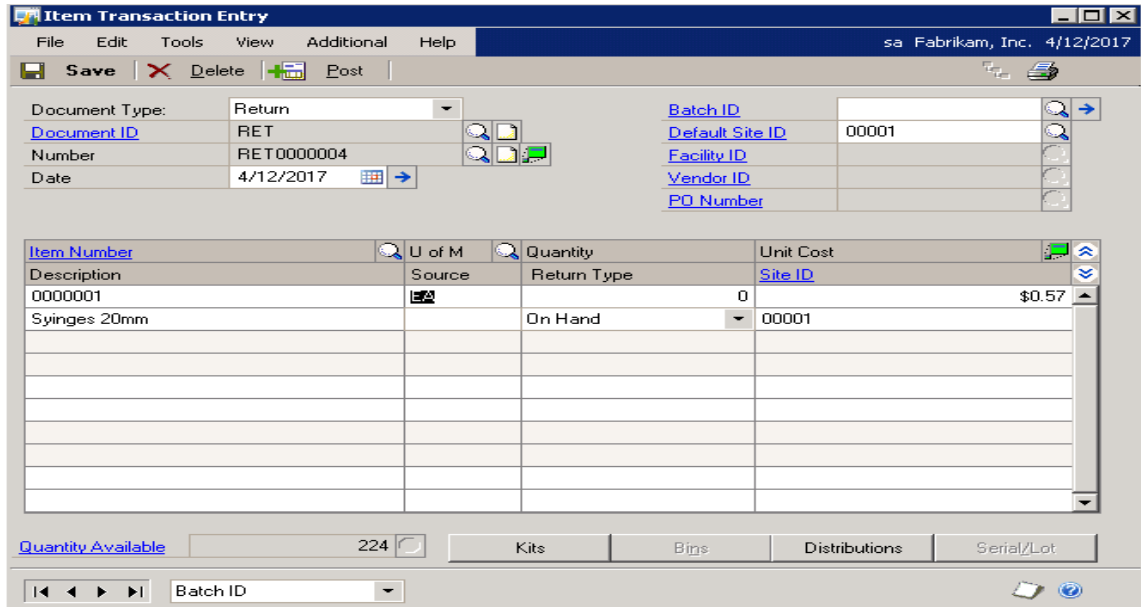Students will be asked to create several PO, Inventory Issue, and Return transactions in several handson labs. Students will keep track of inventory level of stock items using the Inventory Tracking Form (see Table 1). They will be able to learn Purchasing and Inventory Control process by going through the labs several times.

Table 1: Inventory tracking form

Transaction #	Transaction Type	Item #	Opening Inventory	Issue/Purchase Quantity	Closing Inventory
1					
2					
3					
4					
5					
…					
.					

CONCLUSION

In this paper, we provide a guideline for teaching healthcare materials management in an undergraduate course using an ERP system that is capable of handling healthcare materials management. We start with explaining materials management process and identifying some subtle differences between materials management process in healthcare and other industry. Next we go through several hands-on labs using Microsoft Dynamics GP with healthcare materials management functions created *by BinaryStream*'s add-on software. Parameter setup example is shown first in lab hands-on. Purchasing process is described next followed by the inventory transaction process. An inventory tracking form is used in the lab to track inventory level of stock items. It is expected that these hands-on assignments will be useful for undergraduate majors in General Business, Management, Supply-Chain Management, Health Informatics, and Business Information Systems. One or two of these labs may also be used in the MIS course that is required for all business majors.

REFERENCES

BinaryStream Software, Inc. (2012). *Healthcare materials management user guide for Microsoft Dynamics GP 10 and GP 2010: An enterprise solution developed by BinaryStream.* Burnaby, BC, Canada: BinaryStream Software, Inc.

Callender, C. (2007). Barriers and best practices for material management in the healthcare sector (Unpublished master thesis). The University of Missouri, Rolla.

Jarousse, L. A. & Lazar, C. (2011). Strategic supply chain management, *H&HN magazine.* Retrieved from http://www.hhnmag.com/hhnmag/jsp/articledisplay.jsp?dcrpath=HHNMAG/Article/data/12DEC2011/1211 HHN_Feature_Gatefold&domain=HHNMAG

Microsoft Dynamics GP, Purchase order processing document. Retrieved from http://mbs.microsoft.com/downloads/public/.../PurchaseOrderProcessing.pdf

Minahan, T. (2007). Can supply management technology be the antidote to the healthcare crisis? *Health Management Technology*, 28 (9), 52.

Poulin, E. (2007). Benchmarking the hospital logistics process: A potential cure for the ailing health care sector. Retrieved from http://logisticsmanagementandsupplychainmanagement.wordpress.com/2007/03/27/benchmarking-the-hospital-logistics-process/

Sweeney, D., Campbell, J., & Mundy, R. (2010). Teaching supply chain and logistics management through commercial software, *The International Journal of Logistics Management*, 21(2), 293-308.

Tonzetich, G. (2012). Inventory control in healthcare, *BinaryStream*, Retrieved from http://www.binarystream.com

APPENDIX A

Suggested Topics, Reading materials, and Labs

	Topic	Materials Covered	Lab Exercise	Time (suggested)
1	Healthcare Materials Management/Supply Chain Concept	Appendix-B: Resource 1, 3 and a textbook chapter of instructor's choice	None	1 Week
2	ERP Systems	Appendix-B: Resource 2, 4, 5. A textbook chapter or Resource 6	MS Dynamics GP Navigation	1 Week
3	Materials management (MM) Setup and Transactions	Appendix-B, Resource 2 and Lab Handout*	MM Setup, Transactions, and Inventory Tracking Form	1 Week
4	Purchase Order Process (POP)	Appendix-B: Resource 2 and Lab Handout*	POP Setup, Transactions, and Inventory Tracking Form	1 Week
5	MM and POP Reporting	Appendix-B: Resource 2 and Lab Handout	MS Dynamics GP Reporting tools	½ Week
6	Exam	Multiple-choice, short-answer questions, and hands-on		½ Week

* Outlines of the Labs have been provided in the Razi_Han article, students will require a little more detailed handout for all labs.

APPENDIX B

Resources

- What is Supply Chain Management? http://www.youtube.com/watch?v=Mi1QBxVjZAw

- BinaryStream User Guide, 2012: Healthcare Materials Management™ User Guide for Microsoft Dynamics™ GP 10 and GP 2010 An Enterprise Solution developed by *BinaryStream*. **Binary Stream Software, Inc.**, 201 - 4238 Lozells Avenue, Burnaby, BC V5A 0C4, Canada

- Callender, C. and Grasman, S.E. (2010), Barriers and Best Practices for Material Management in the Healthcare Sector, *Engineering Management Journal*, 22(4), 11-19.

- Introduction to ERP Systems. http://www.youtube.com/watch?v=SIge-EAUXiI

- Microsoft Dynamics GP, Purchase Order Processing document (mbs.microsoft.com/downloads/public/.../PurchaseOrderProcessing.pdf)

- Moller, C. (2005), ERP II: a conceptual framework for next-generation enterprise systems? *Journal of Enterprise Information Management,* 18(4), 483-497.

- Using a Virtual Machine to Explore BSSI Software. Instructions for Microsoft Dynamics™ GP 2010 Environment. **Binary Stream Software, Inc.**, 201 - 4238 Lozells Avenue, Burnaby, BC V5A 0C4, Canada

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