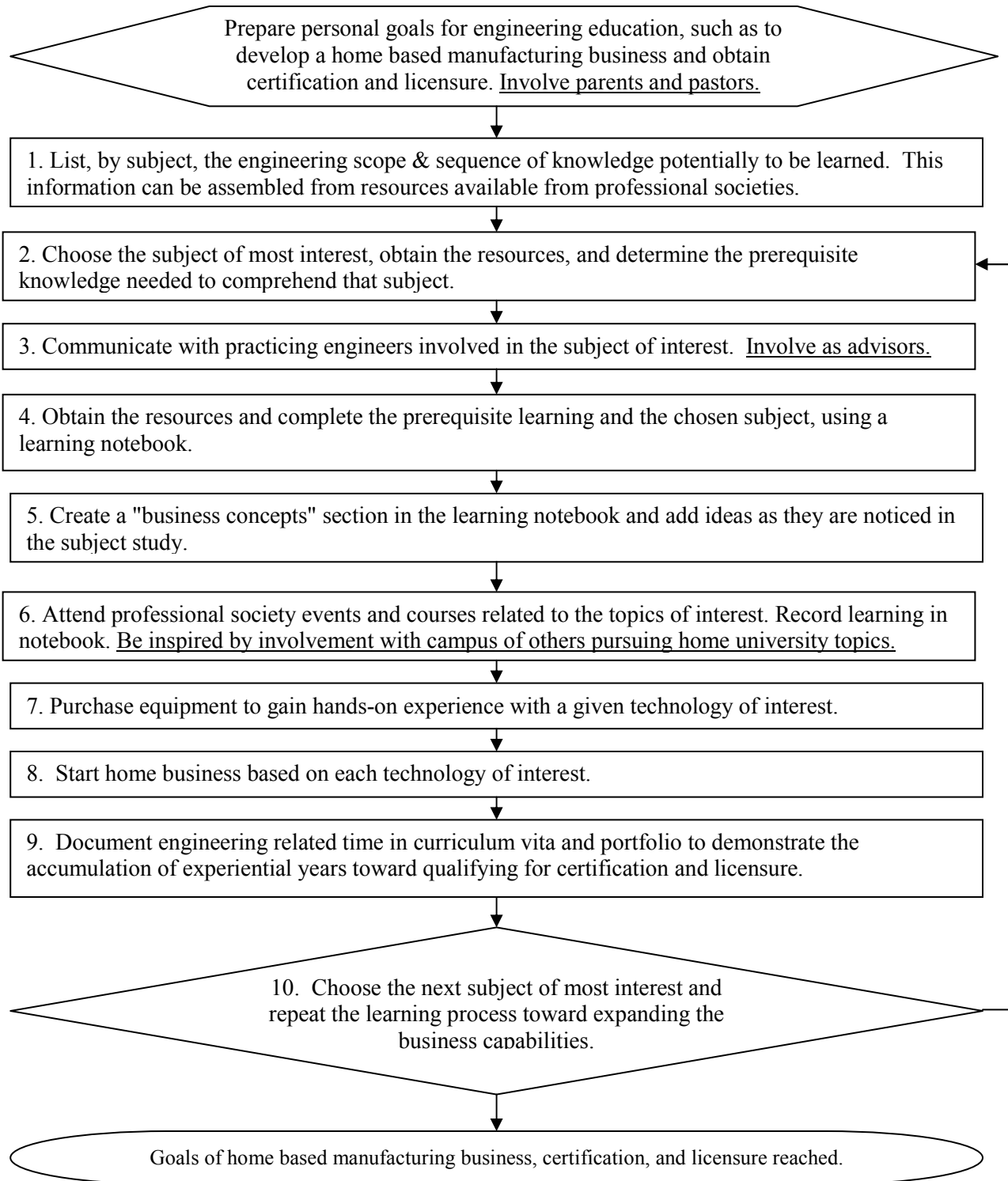


A Flowchart for Learning Engineering at Home



"Scientists discover the world that exists; engineers create the world that never was."

*Theodore Von Karman,
a renown aerospace engineer*

A Curriculum for Learning Engineering at Home

Subject(s): Educational Outcome(s)	Educational Method(s)
Introduction to Manufacturing Engineering: Understand what manufacturing engineers think about and do.	Become a Society of Manufacturing Engineers member with all associations and read publications and website thoroughly. Interview practicing manufacturing engineers.
Introduction to Business: Understand the world of business and entrepreneurship.	Interview practicing business persons. Create list of business development resources. Attend business related meetings in the community.
Project Management: Understand the techniques and value.	Purchase project management software and use it extensively during curriculum accomplishment and business development.
Calculus, Matrices, Differential Equations: Be able to use these mathematical tools proficiently in both business and engineering applications.	Set-up and solve hypothetical home business and manufacturing engineering problems of interest.
Workstation Design: Understand the human factors, ergonomics, and safety issues in manufacturing.	Configure a home laboratory and shop using the principles learned.
Chemistry: Be able to make own chemical glassware and perform all chemical experiments of interest representing broad experiences.	Set-up home chemistry laboratory with glass blowing capabilities. Glass blowing was a required talent of chemists in the early 20th century.
Technical Writing: Be able to write professional engineering documents.	Invent something, then write and submit the patent application yourself. Write the business plan for your home business. Write a grant proposal application to build your home business.
Technical Drawing: Be able to create professional engineering drawings. This would include study of geometric dimensioning and tolerancing.	Use CAD to create patent drawing with submitted patent application. Purchase CAD software and become proficient to offer services to local companies.
Computer Programming: Become proficient at C++ programming.	Purchase C++ software and hardware to automatically collect data, analyze data, and report data on the web. This could be connected to a particular chemistry experiment of interest (e.g., galvanic corrosion progress over time).
Computer-aided Manufacturing: Become proficient at programming computer controlled milling and turning machines.	Purchase bench top computer controlled mill and computer controlled lathe. Offer small part production services to industry.
Physics, Statics and Dynamics, Strength of Materials: Appreciate the fundamental nature and applications of these subjects to design and manufacture.	Construct and perform physical experiments, purchase low cost test equipment, offer engineering demonstrations for nominal fee to local groups. Learn to fly and obtain a private pilot rating.
Manufacturing Processes: Understand basics of all common manufacturing processes and have depth of understanding in two chosen processes.	Purchase vacuum investment casting system and plating system to make jewelry for sale to local stores.
Engineering Economics: Be able to use the tools of engineering economy to make business decisions.	Apply each topic to developing additional business for existing capabilities.
Design for Manufacturing: Understand the broad perspective of DFM and be able to implement two DFM strategies.	Implement two DFM strategies to improve business performance. Document and publish the results in SME conference proceedings.
Thermodynamics, Heat Transfer, and Fluids: Be able to identify significance of these sciences in manufacturing and apply to improvement of a process.	Improve the performance of a process based on each of these sciences. For example, increase tool life by choosing coolant with higher heat transfer coefficient and relate to mathematical theory.
Electrical Engineering: Understand the fundamentals and learn electronics manufacturing applications.	Purchase waveform generator, oscilloscope, and other basic electronics laboratory equipment with supplies. Perform experiments to complement study of fundamental. Build simple useful circuits towards a marketable product.
Evaluation of Engineering Data: Understand how to apply probability and statistical methods to improve product quality.	Perform design of experiments on process of interest. Through local visits, document examples in local industry where each technique is used and why. Offer one technique of interest as a service to a company in need of its results.
Composite Materials Manufacturing: Understand the materials, processes, and business.	Make two Kevlar canoes and sell one to pay for the other.
Quality Assurance and Control: Understand and use tools of quality in context of ISO 9000 requirements.	Apply knowledge by initiating quality system toward ISO 9000 requirements on home business activities. Serve local companies in their quality program developments.
Automated Manufacturing Systems: Understand the options and how to make appropriate economic decisions for the implementation of automation.	Purchase robot to perform a repetitive or dangerous task in the home business (e.g., pouring hot metal during vacuum investment casting).
Production and Inventory Control: Learn the respective techniques and apply.	Apply techniques to home business and document the cost savings. Offer this as another service to other small businesses in need.
Manufacturing Facility Design: Learn how to construct and implement a plant layout that is economically justified.	Incorporate a plant layout analysis into the expansion plans for the home business.
Simulation of Business and Industrial Systems: Understand the techniques and value.	Purchase simulation software to simulate and improve current business and industrial processes.