# Report on
# Game Design and Development Courses
## Meeting Knowledge Areas

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**Summer 2014**
**Revised Fall 2014 and Spring 2015**

## Abstract

This document approaches a Game Design and Development (GDD) degree program as one that emphasizes the practical, hands-on-nature of the design and development aspects of these areas. More specifically, it is a program that seeks to create a student, who upon completion of the degree requirements, will have sufficient background and experience in each GDD area as to be able to function at an independent level in the gaming workforce with minimal supervision and instruction necessary. In sum the *"and"* is really a *"for"* making the GDD degree a Game Design FOR Development degree.

We are also considering two different perspectives of approach: one from the Art-Design side and the other from the CS-side. In both cases there is also the implication that the program must provide the student the knowledge and skills needed to acquire a job in the general area of Art-Design or in the general area of CS, where again they would require minimal supervision and additional instruction.

The motivation of this document is to identify areas of possible improvement in the existing GDD programs based on identification and coverage of core topics and knowledge areas (KA). The Computer Science KA descriptions are based on the ACM and IEEE's *Computer Science Curricula 2013* (CS2013). The Core Topics for Game and Game Development are derived from the International Game Developer's Association's (IGDA) most recent *Curriculum Framework for the Study of Games and Game Development* (CFSGGD). Information on the Art components and knowledge areas are derived from the *National Association of Schools of Art and Design (NASAD) Handbook 2013-14* (NASAD14).

This approach may hopefully serve as a basis for the creation of GDD programs in other universities. It may also be extended to cover other areas of GDD specialization beyond Art and CS, for example in the areas of Music or Business or Marketing.

This report begins with a summary and moves into discussion and derivation thereof. The summary is then repeated later in the document.

**Executive Summary of Findings**
**Total Core Hours for Game Design and Development**

*The core GDD lecture hours required for a broad awareness in each topic area is 90 lecture hours. This is roughly 12 credit hours ((90/15)\*2).*

*Per ABET requirements for a CS degree (B.S.) the Computer Science side of the GDD major has 42 credit hours available to dedicate to game design and development.*

*Per NASAD requirements for a Fine Arts (B.F.A.) degree in Design the Art side of GDD has 20 credit hours available to dedicate to game design and development.*

*On the CS side: Subtracting 12 hours from 42 leaves 30 credit hours open for further topic exploration.*
*On the Art side: Subtracting 12 hours from 20 leaves 8 credit hours open for further topic exploration.*

A similar analysis could be done to identify the needs of Business-side, or Music-Side, or other-discipline-side GDD majors. Such analysis might prove useful in better establishing core GDD material as well as further overlap with other majors.

| Topic Area | GDD Core | GDD-Art Add | GDD-CS Add |
|---|---|---|---|
| Critical Game Studies | 5 | 0 | 3 |
| Games and Society | 5 | 0 | 0 |
| Game Design | 25 | 0 | 10 |
| Technical Development | 15 | 0 | 20 |
| Visual Design | 15 | 20 | 0 |
| Audio Design | 5 | 0 | 0 |
| Interactive Storytelling | 5 | 0 | 0 |
| Game Production | 10 | 0 | 0 |
| Business of Gaming | 5 | 0 | 0 |

Table 1: Summary of GDD Lecture Hours. Divide by 3 to get credit hours.

The "adds" in Table 1 are areas where additional material specific to game design and development may be necessary. These reflect industry expectations of abilities with the stated emphasis of concentration and a general observation of the typical courses offered for a given major.

For example, the typical CS program does not offer much exploration of *critical reviews*, thus for a GDD-CS major to meet the expectations of industry a student with that major should seek an additional course that provides such. This contrasted with an Art program which does typically offer exploration of critical reviews and thus the Art student would not need such additional material.

As another example a GDD-CS major would be expected by industry to have a higher skill in technical (programming) ability than an Art student. And likewise a GDD-Art major would be expected to have a higher skill in visual design than a CS student.

In sum this means there will be GDD courses that are only needed to be taken by GDD-CS students and there will be GDD courses that are only needed to be taken by GDD-Art students. Simplistically these needs could be met by unique GDD courses. However they may also be met by courses in Art specific for GDD students and courses in CS specific for GDD students.

# 1 Measurement of Time

First, a discussion of time, Knowledge Areas (KAs), and topic areas is necessary to establish consistency of measurement across the various documents used as reference. This establishes terms, definitions, and a context of understanding how to measure time spent in teaching material from a given area of interest.

## 1.1 Lecture Hours and CS Knowledge Areas

CS2013 describes an "hour" as:

> *The time required to present the material in a traditional lecture-oriented format. The hour count does not include any additional work that is associated with a lecture (e.g., in self-study, laboratory sessions, and assessments). This does not mean the material must be presented in a lecture format. This measurement unit is used here as it has proven: understandable in (and transferable to) cross-cultural contexts (CS2013).*

This document will likewise define 'hour' and for clarity will use 'lecture hour' to reference the same unit. This measure is used in the below table which shows the recommended hours for each major KA for a Computer Science Program (CS2013).

| Computer Science Knowledge Area | Tier-1 | Tier-2 |
|---|---|---|
| AL - Algorithms and Complexity | 19 | 9 |
| AR - Architecture and Organization | 0 | 16 |
| CN - Computational Science | 1 | 0 |
| DS - Discrete Structures | 37 | 4 |
| GV - Graphics and Visualization | 2 | 1 |
| HCI - Human-Computer Interaction | 4 | 4 |
| IAS - Information Assurance and Security | 3 | 6 |
| IM - Information Management | 1 | 9 |
| IS - Intelligent Systems | 0 | 10 |
| NC - Networking and Communications | 3 | 7 |
| OS - Operating Systems | 4 | 11 |
| PBD - Platform-based Development | 0 | 0 |
| PD - Parallel and Distributed Computing | 5 | 10 |
| PL - Programming Languages | 8 | 20 |
| SDF - Software Development Fundamentals | 43 | 0 |
| SE - Software Engineering | 6 | 22 |
| SF - Systems Fundamentals | 18 | 9 |
| SP - Social Issues and Professional Practice | 11 | 5 |
| **Total Core Hours** | **165** | **143** |

**Table 2: Computer Science Knowledge Areas**

Each major KA is divided into units and has described outcomes in the CS2013 document. In summary, it is expected that a CS major will be exposed to 100% of Tier-1 hours and minimally 80% of Tier-2 hours along with a variety of elective material. Thus every Computer Science curriculum should have course requirements to reflect this exposure (CS2013).

So from CS2013, for the GDD major to count as a CS based degree students, GDD majors with a CS orientation must be exposed to 165 hours of Tier-1 topics and to at least 80%, or 115 hours, of the Tier-2 topics. This gives a total requirement of 280 lecture hours or 38 credit hours ((280 / 15) * 2).

## 1.2 Credit Hours and Art Design

A similar discussion for the minimum requirements for a *Design* based art major is given in NASAD14. Specifically for the award of a B.F.A. in a Design Practice Specialization (Appendix II.A.section 4, part B) it reads:

> There are many design practice specializations. Historic examples include communication design, fashion design, industrial design, interior design, and textile design.
>
> There are many other titles indicating areas of recent focus or areas of greater focus within a larger specialization. Examples include, but are not limited to interaction design, experience design, wayfinding, information design, product design, design strategy, **game design**, and advertising design. New specializations are expected.
>
> Institutions choosing to offer studies in or about a particular specialization are also choosing to provide the curricular and resource support essential for acquiring the appropriate knowledge and skills given the specified type and level of study.
>
> Institutions choosing to provide professional practice preparation in a specialization are choosing to make a significant level of perpetual commitment to support the requisite focused curriculum and provide associated resources. See Sections 6 and 7 of this Appendix.
>
> The same principle applies to programs focused on the preparation of researchers and scholars of design at advanced levels, or on any other design-related subject, such as design pedagogy.

Continuing in NASAD14, Appendix II.A.Section 5, item B.1:

> **Professional Undergraduate Degrees with Majors in Design Specializations**
> Four-year professional undergraduate degrees that meet NASAD standards for specific design specializations – communication design, fashion design, industrial design, interior design, textile design, etc. – address development of the common body of knowledge and skills required for career entry as a designer upon graduation.
>
> In order to develop requisite competencies, **degrees in this category normally require at least 65%** of the course credit to be **in design and design-related subjects**, with **25% of the course credits within this 65%** devoted specifically to the particular **area of design specialization** designated **by the degree title**.

From these comments GDD majors with an Art orientation should be exposed to courses such that at least 65% of the total number of credit hours is dedicated to design and design-related subjects. This amounts to 78 credit hours of a 120 hour program. With 25%, or 20 credit hours, dedicated to game design and development. Notice these are "credit hours" which should not be confused with the previous mentioned KA lecture hours.

To describe the relationship to lecture hours in knowledge areas related to game design and development, we will approximate that half the class hours are spent as "lecture hours." This yields an estimation of 150 lecture hours ((20 hrs * 15 wks/semester) /2) be dedicated to discussion on topics specific to game design and development.

## 1.3 Relation of Lecture Hours to Credit Hours to Physical Hours

For clarity of discussion on hours, two perspectives have been introduced. The first is in lecture hours. The second is in credit hours.

Traditionally, for a student to achieve an undergraduate degree, the student is expected to be in college for four years, or a total of eight semesters. Each semester the student, on average, is expected to enroll in 15 credit hours. This creates an environment where most degree programs require a student to take a total of 120 credit hours. Within this context anywhere from 40 to 50 credit hours are used to meet university general education requirements. This leaves 70 to 80 credit hours to dedicate to the major's department requirements and to the major. For brevity of discussion, assume the university's general education requirements are 40 credit hours. So we will use 80 credit hours as the available total hours for GDD courses.

With the assumption we have 80 credit hours, and a 15 week semester, this equates to 1200 physical hours that could be "lecture hours." However, practical experience reduces this. This reduction is to account for the administration of tests and quizzes, going over the answers to homework, tests, and quizzes, in-class grading, in-class problem workouts, explanation of tool usage, description of course structure, book structure, processes related to the material that are not directly part of the material, answering student questions, dynamic adaptation or addition of material, and other unplanned events and distractions. All of these items are valuable to the educational process and reflect the nature of teaching and education. However, for the sake of discussion, we will approximate and make an assumption that half of the physical hours make up "lecture hours." This again is not to diminish the importance of non-lecture discussion or impose a teaching style. This estimation serves only to allow an epsilon in the discussion of hours, which in turn allows for diversity in teaching styles and meeting the needs of students. As a practical example, consider the scenario where there is 60 minutes allocated for a talk. An experienced speaker will only plan a presentation that is roughly 40 minutes long, on the assumption 20 minutes will be needed to answer questions.

Application of this 1 to 2 ratio of approximation to the 80 credit hours amounts to 600 lecture hours available for program course requirements. For the CS side subtracting the 38 credit hours (280 lecture hours) of required Tier-1 and Tier-2 KA content leaves 42 credit hours for GDD course work. For the Art side 80 credit hours are dedicated to design and design-related subjects. Per NASAD14, 25% of that 80 must be dedicated to the GDD specialization. Thus the Art side has 20 credit hours available for GDD coursework. So to meet the requirements of both sides of emphasis means the GDD core KA material cannot exceed 20 credit hours, and if it is to allow any selective specialization must be less than that.

***It will next be shown the core GDD lecture hour requirement is only 90, or roughly 12 credit hours. This allows for at least 8 credit hours of selective specialization and other GDD specific topics to be presented as the instructors, students, or GDD program director may see most appropriate.***

## 2 Game Design and Development Knowledge Area Requirements

Recapping, a 120 credit hour major has the hours available to meet the general KA requirements for a CS or Art Design based degree. To make the degree a Game Design and Development (GDD) degree requires the addition of some core topic knowledge areas that are specific to game design and development. Due to the needs of the Art Design based major; the GDD core KA time requirements must be less than 20 credit hours (150 lecture hours). However the GDD requirements have yet to be identified. The IGDA's Curriculum Framework (CFSGGD) will be used to assist in their identification.

The CFSGGD identifies three overlapping areas of game study:

- Game Design – focused mainly on interaction and interface design
- Game Development – focused mainly on the production of games, especially with regard to technologies used in creating a game
- Game Studies – focused on exploring games as cultural artifacts (pieces of media) as well as the theoretical aspects of game play

Notice these areas are in line with the previously stated objective for a Game Design and Development Program. In summary, the GDD Program, as indicated by the name, is focused on the practical aspects of the area of Game Design and the area of Game Development while still requiring the necessary background in the area of Game Studies.

The CFSGGD also identifies nine, overlapping, Core Topics of a games-related education:

1. Critical Game Studies
2. Games and Society
3. Game Design
4. Game Programming (Technical Development)
5. Visual Design
6. Audio Design
7. Interactive Storytelling
8. Game Production
9. Business of Gaming

It is explicitly mentioned there is overlap of subtopics of these core topics and there currently is no universal agreement on a small set of core topics that all games programs should cover. As the CFSGGD document was identifying the totality of need in each topic. We will now seek to separate some of the overlap from the topic descriptions of the CFSGDD, the CS2013, and NASAD14. This will allow at least partial identification of what material a GDD major is expected to know beyond that of the core material of a CS major and Art-Design based major.

In the sections that follow each topic area provides a numeric value identified as *GDD Lecture Hours*. This can be taken as the "core" hour requirement for all GDD majors.  Also provided are Additional Art-GDD Hours and Additional CS-GDD Hours. These are hours in addition to the core amount required for an Art-sided GDD student and a CS-sided GDD student respectively. These additional hours are reflective of industry expectations of a particular side of emphasis. Also related to such expectations are the hours relevant to the topic area covered in the core portions of Art or CS, based on the content of NASAD14 or CS2013 respectively. These hours are identified in each section as "expected."  For example, "expected 0 Art, 3 CS" means there is no coverage of the topic in core Art courses, but at least 3 hours covered in core CS courses. In general this means the theory is covered but the direct application to game design and development is not. This information is included to illustrate: how GDD topic areas overlap with Art and CS, how each allows more specialization in certain GDD topic areas than another, and how industry

expectations can be accounted for in topic area requirements. To a lesser degree it also indicates why industry may have different expectations for different sides of emphasis.

The following sections will more explicitly demonstrate: GDD course topics overlap Art and CS courses (as expected and specifically stated in CFSGGD) and industry expectations are different for each side of emphasis. Thus some GDD courses may only be required to be taken by CS-side students and some may only be required to be taken by Art-side students. These do not have to explicitly be GDD courses but may be offered as support courses within the Art or CS or even other departments, depending on the university, department, and GDD program structures.

In sum: a Game Design and Development student must take an estimated course load that has a minimum of 90 core lecture hours, or rather 12 credit hours, plus meet all the core requirements for the topical side of specialization (i.e. Art or Computer Science). This does not mean the student automatically has a major in the specialized topic area and a minor in GDD, for only the core requirements of the specialized topic are required to be met. To complete the major would require additional material in that topic area. While the student may take that material, the student for the GDD major must take courses that provide additional material in the GDD areas, as shown in Table 3.

| Topic Area | GDD Core | GDD-Art Add | GDD-CS Add |
|---|---|---|---|
| Critical Game Studies | 5 | 0 | 3 |
| Games and Society | 5 | 0 | 0 |
| Game Design | 25 | 0 | 10 |
| Technical Development | 15 | 0 | 20 |
| Visual Design | 15 | 20 | 0 |
| Audio Design | 5 | 0 | 0 |
| Interactive Storytelling | 5 | 0 | 0 |
| Game Production | 10 | 0 | 0 |
| Business of Gaming | 5 | 0 | 0 |

**Table 3: Revisit of GDD Lecture Hours.**

We will now spend some time discussing what each of these GDD topic areas covers. Much of this discussion is derived from that presented in the International Game Developer's Association's (IGDA) most recent *Curriculum Framework for the Study of Games and Game Development* (CFSGGD) which the reader is strongly encouraged to examine.

Note we deviate slightly from the CFSGGD and have renamed *Game Programming* to be *Technical Development*. This is done to hopefully better encompass what the CFSGGD description discusses, particularly since its depth of understanding goes beyond just programming.

Also in each discussion we described "industry expectations" this is based on the author's personal experience and in-depth conversations with other game industry and academic professionals. In majority it is an opinion statement, not an empirical statement nor the result of a formal study, and as such could be improved upon in future writings. The intent is to establish a framework of discussion of such. More specifically how to identify what a GDD major looks like, and what courses are required, as approached from different areas of specialization.

## 2.1 Critical Game Studies

Per CFSGGD, this is divided into two subtopics of game criticism and media studies. Neither are topics that are typically addressed in core CS courses, though there are weak relations to the Computational Science (CN), Human Computer Interaction (HCI), and Social Issues and Professional Practice (SP). While covered conceptually in Art courses, application to games specifically is not. So demonstration of such would still be needed by Art-side students.

Industry expectations are about equal with regard to this topic area for Art and CS-side students. Students on the CS-side should take additional courses to balance their abilities with the Art-side.

*GDD Lecture Hours: 5*                                                                    Additional GDD-Art Hours: 0
                                                                                         *Additional GDD-CS Hours:  3*

Expected lecture hours gained in non-GDD courses: 3 Art, 0 CS
Suggested Student Activities:          Write a game review
                                       Read a game criticism
                                       Write a game criticism

## 2.2 Games and Society

Per CFSGGD, this topic draws heavily on sociology, anthropology, cultural studies, and psychology to offer insights into the worldwide culture of gaming. This would loosely relate to the CS knowledge area of Social Issues and Professional Practice, but is much more gaming specific than typically covered in a general CS context. The general concepts of this topic area are also likely related to various topics in Art courses, but again specific discussion of games would not typically be covered.

Industry expectations are about equal with regard to this topic area for Art and CS-side students. Additional understanding in this area would be beneficial to all GDD students.

*GDD Lecture Hours: 5*                                                                    Additional GDD-Art Hours: 0
                                                                                         Additional GDD-CS Hours:  0

Expected lecture hours gained in non-GDD courses: 0 Art, 0 CS
Suggested Student Activities:

## 2.3 Game Design

A number of subtopics of Game Design, as described in CFSGGD, overlap with core topics of CS and Art. However the subtopics are very specific to games and the level of detail is not likely covered in core Art or CS courses. The subtopics are by nature hands-on oriented and fall into a category of applied theory (of Math, CS, Art, English, Business, as well as other disciplines).

Industry expectations are slightly higher toward Art-side students with regard to this topic area than expectations for CS-side students. CS students need to take additional (game) design courses to better balance their abilities with the Art-side.

This area is very gaming specific and the concepts here are very important to all GDD majors. However, it is likely the Art side gains additional expertise in this area by the general nature of coursework required for Art Design aspects. In sum, this area needs to be covered in a GDD course required to be taken by both CS and Art students, but the Art students will have significantly more exposure to the concepts in other courses. Because of this the CS students some need additional design-related material to achieve the expectations of industry, but are not expected to be as proficient as Art-side students.

*GDD Lecture Hours: 25*                                            Additional GDD-Art Hours: 0
                                                                   *Additional GDD-CS Hours: 10*

Expected lecture hours gained in non-GDD courses: 15 Art, 3 CS
Suggested Student Activities:     Prototype a non-video game, Document a non-video game
                                  Prototype a video game, Document a video game
                                  Prototype a serious game

## 2.4 Technical Development (Game Programming)

It is important to note this topic is NOT just programming. Specifically the subtopics, as described in CFSGGD, touch on Math, Physics, and CS courses and go beyond the basic idea of programming. The content overlaps at least in a theoretical sense with virtually every KA of CS. It has major overlap in both theory and practice with Software Development Fundamentals (SDF) and Software Engineering (SE). It does advance the idea of "tool development" as well as sound and audio programming, and play analysis.

Based on general industry expectations this area is one CS-side students should excel. However, expectations are significantly less in this area for the Art-side students. This causes a situation where more hours are needed by the CS-side students than are needed by the Art-side students. We see this relationship reversed in other topic areas.

In sum, this area needs to be covered in great depth by CS side students, and more lightly by the Art side students. However all GDD students are required to take a course in this area.

*GDD Lecture Hours: 15*                                            Additional GDD-Art Hours: 0
                                                                   *Additional GDD-CS Hours: 20*

Expected lecture hours gained in non-GDD courses: 0 Art, 30 CS
Suggested Student Activities:     Program a video game with sound, Document a video game
                                  Implement a Game Engine including the Physics
                                  Implement a Game based on the engine
                                  Implement a level maker or other game assist tool
                                  Implement a game that uses the output of the tool

## 2.5 Visual Design

Per CFSGGD, this topic covers the design, creation, and analysis of the visual components of games. This is likely a topic covered well by Art courses, though application to games may not explicitly be mentioned.

This is an area where industry has higher expectations for the Art-side students than for the CS-side students. Yet both sides need to understand the principles and tools of this topic area.

GDD Lecture Hours: 15                                   *Additional GDD-Art Hours: 20*
                                                        Additional GDD-CS Hours: 0

Expected lecture hours gained in non-GDD courses: 25 Art, 0 CS
Suggested Student Activities:    Demonstrate understanding of how to use 2D and 3D visual design tools
                                 Create a non-trivial 2D or 3D animation of a character
                                 Import 2D and 3D visual assets into a game


## 2.6 Audio Design

Per CFSGGD, this topic addresses the design and creation of sound and sound environments, in general and specifically for use in video games. It is not covered in the core content of CS or Art Design.

With regard to CS or Art side students in GDD, industry expectations tend to be low in this topic area.

*GDD Lecture Hours: 5*                                  Additional GDD-Art Hours: 0
                                                        Additional GDD-CS Hours:  0

Expected lecture hours gained in non-GDD courses: 0 Art, 0 CS
Suggested Student Activities:    Create a sound/music track
                                 Import it into a game
                                 Write a report that analyzes the use of audio in an existing game

## 2.7 Interactive Storytelling

Per CFSGGD, this topic covers traditional storytelling and narrative interactive media. This does not overlap with any CS KA. It is also not typically covered in Art-Design core courses, but may be covered in related material. It may also overlap with general requirements of the university.

Industry expectations of CS and Art students are equal with regard to this topic area. Both sides are expected to be able to understand, relate to, and implement basic principles. Additional hours beyond the suggested core would be beneficial to all GDD majors.

*GDD Lecture Hours: 5*                                  Additional GDD-Art Hours: 0
                                                        Additional GDD-CS Hours:  0

Expected lecture hours gained in non-GDD courses: 1 Art, 0 CS
Suggested Student Activities:    Write a short story (or two)
                                 Use interactive media to tell the story
                                         Note: the author does **not** run the media for the audience
                                         The audience runs the media
                                 Tell the story
                                         Author relays the story verbally with or without images/effects

## 2.8 Game Production

Per CFSGGD, this topic covers the management aspects of developing games. It overlaps with Software Engineering (SE) and Software Development Fundamentals, but adds more business oriented subtopics.

Industry expectations of CS-side students tend to be slightly higher than the expectations of Art-side students with respect to this topic area. All GDD students should be exposed to this area.

*GDD Lecture Hours: 10*                                    Additional GDD-Art Hours: 0
                                                           *Additional GDD-CS Hours:  3*

Expected lecture hours gained in non-GDD courses: 0 Art, 3 CS
Suggested Student Activities:        Create Game Proposal, Create Game Concept Document
                                     Create Game design Document, Create Asset List
                                     Create Project Burn down Schedule
                                     Demonstrate use of management tools
                                     Create Test Plan

## 2.9 Business of Gaming

Per CFSGGD, this topic covers the economic and legal aspects of games. Some of this topic may be covered by general education requirements of the university. However this is more game specific.

Industry expectations of CS and Art students are equal with regard to this topic area. Both are expected to be able to understand, relate to, and implement basic principles. Additional hours beyond the suggested core would be beneficial to all GDD majors.

*GDD Lecture Hours: 5*                                     Additional GDD-Art Hours: 0
                                                           Additional GDD-CS Hours:  0

Expected lecture hours gained in non-GDD courses: 0 Art, 0 CS
Suggested Student Activities:      Create Marketing Material

# 3 Total Core Hours for Game Design and Development

*Summing the core GDD lecture hours from the above sections yields a total of 90. This is roughly 12 credit hours ((90/15)\*2). Recall the CS side of GDD has 42 credit hours to dedicate to game design and development, but the art side has only 20. Subtracting 12 from both of these and leaves the Art-side with 8 credit hours for further GDD topic discussion and leaves the CS-side with 30 credit hours.*

Notice similar analysis could be done to identify the needs of Business-side, or Music-Side, or other-discipline-side GDD majors. Such analysis might prove useful in better establishing core GDD material as well as further overlap with other majors.

| Topic Area | GDD Core | Art Add | CS Add |
|---|---|---|---|
| Critical Game Studies | 5 | 0 | 3 |
| Games and Society | 5 | 0 | 0 |
| Game Design | 25 | 0 | 10 |
| Technical Development | 15 | 0 | 20 |
| Visual Design | 15 | 20 | 0 |
| Audio Design | 5 | 0 | 0 |
| Interactive Storytelling | 5 | 0 | 0 |
| Game Production | 10 | 0 | 0 |
| Business of Gaming | 5 | 0 | 0 |

Table 4: Summary of GDD Lecture Hours Revisted.

The "adds" in the table above are areas where additional material specific to game design and development may be necessary. These reflect industry expectations of abilities with the stated emphasis of concentration and a general observation of the typical courses offered for a given major. These are independent of other requirements for a specific emphasis (i.e. CS still must meet CS requirements too). Perhaps better headings would be GDD-Art and GDD-CS.

For example, the typical CS program does not offer much exploration of *critical reviews*, thus for a GDD-CS major to meet the expectations of industry a student with that major should seek an additional course that provides such. This contrasted with an Art program which does typically offer exploration of critical reviews and thus the Art student would not need such additional material.

As another example a GDD-CS major would be expected by industry to have a higher skill in technical (programming) ability than an Art student. And likewise a GDD-Art major would be expected to have a higher skill in visual design than a CS student.

In sum this means there will be GDD courses that are only needed to be taken by GDD-CS students and there will be GDD courses that are only needed to be taken by GDD-Art students. Simplistically these needs could be met by unique GDD courses. However they may also be met by courses in Art specific for GDD students and courses in CS specific for GDD students.